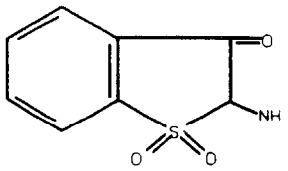
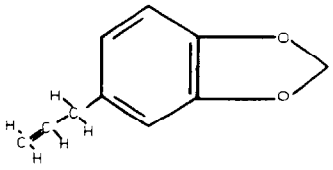
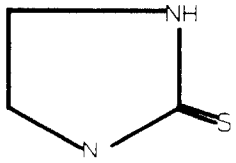
REVIEW AND EVALUATION OF ENVIROCORP'S REFERENCE MOLECULE APPROACH FOR DEVISING DETECTION LIMITS

AND

THEORETICAL ABILITY TO MODEL FATE AND TRANSPORT OF HIGHLY COMPLEX WASTE STREAMS







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EXECUTIVE SUMMARY

The U.S. Environmental Protection Agency's (EPA) Office of Ground Water and Drinking Water (OGWDW) requested ICF Incorporated (ICF) to review a document prepared by Envirocorp Inc., entitled, "Waste Components, Health-Based Limits, and Concentration Reduction Factors." The GNI Group, Inc./Disposal Systems Incorporated (the petitioner) submitted this document to the Agency to support a modification of their current no-migration variance to cover wastes potentially containing any or all of the constituents listed on 40 CFR §261, Appendix VIII.

As requested by OGWDW, ICF reviewed and evaluated the technical adequacy of Envirocorp's proposed "reference molecule" methodology. Envirocorp used this methodology to derive ad hoc detection limits for constituents that neither have Agency-approved health-based levels nor Agency-approved "surrogate" levels (i.e., detection limits or practical quantitation limits). ICF determined that Envirocorp's reference molecule approach is scientifically valid for deriving ad hoc detection limits. In addition, ICF agreed with all but 22 of Envirocorp's selected reference molecules. ICF has proposed alternative reference molecules for all 22 compounds with the exception of aflatoxin. An extensive evaluation of this constituent indicates that GC/MS is not the appropriate analytical methodology for identification of this constituent. ICF suggests that high pressure liquid chromatography be used for the determination of this macromolecule. Lastly, ICF concludes that the results of Envirocorp's reference molecule analysis can be used in conjunction with the most recent toxicological information contained in EPA's Integrated Risk Information System (IRIS) data base to update Guidance No. 71.

The OGWDW also requested ICF to determine the feasibility and application of computer model simulation to predict the fate and transport of a highly complex mixture of organic and inorganic wastes within the injection zone (aquifer) for as long as the waste remains hazardous. ICF notes that both flow and transport (advection-dispersion) and geochemical models have been utilized to predict fate and transport of hazardous constituents within an injection zone. These models also have been used to demonstrate, with a reasonable degree of certainty, that there will be no migration of hazardous constituents from the injection zone for as long as the waste remains hazardous. Geochemical models, however, are not as widely used as flow and transport models to demonstrate no migration due to the lack of thermodynamic data bases, proprietary codes, etc., for modeling complex mixtures of organic and inorganic wastes. Geochemical models, therefore, are not likely useful to model highly complex waste streams.

Flow and transport models are currently applicable to performing worst-case analysis because petitioners can study dominant or influencing molecules (e.g., constituents that are more mobile and less degradable). Petitioners, however, typically cannot use these models to study multiple reactions in unison. Regardless of the type of model used, it is critically important to evaluate all aspects of deep well injection and the physical, chemical and biological processes that take place in the injection zone and overlying confining zone. This analysis becomes even more important when evaluating fate and transport in a commercial Class I injection well accepting a complex and varied mixture of organic and inorganic wastes.

Finally, ICF believes that additional investigation is needed to determine whether the reference molecule selected for derivation of the ad hoc detection limit, is suitable for modeling purposes. This investigation is necessary because the molecule may contain other functional groups that could increase or decrease the reaction rate of the individual constituent and impact the overall degradation and transformation processes.

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INTRODUCTION

The U.S. Environmental Protection Agency's (EPA) Office of Ground Water and Drinking Water (OGWDW) requested ICF Incorporated (ICF) to review a document prepared by Envirocorp Inc., entitled, "Waste Components, Health-Based Limits, and Concentration Reduction Factors." The GNI Group, Inc./Disposal Systems Incorporated (the petitioner) submitted this document to the Agency to support a modification of their current no-migration variance to cover wastes potentially containing any or all of the constituents listed on 40 CFR §261, Appendix VIII.

The OGWDW specifically requested ICF to: (1) review and evaluate the technical adequacy of the Envirocorp's proposed "reference molecule" methodology for deriving ad hoc detection limits for constituents that neither have Agency-approved health-based levels (HBLs) nor Agency-approved surrogate levels (i.e., detection limits or practical quantitation limits); and (2) determine the feasibility and application of computer model simulation to predict the fate and transport of a highly complex mixture of organic and inorganic wastes within the injection zone for as long as the wastes remains hazardous.

ICF completed the requested analysis of both Envirocorp's proposed reference molecule approach and the feasibility and application of computer model simulations to predict the fate and transport of a hypothetical waste containing all of the constituents listed on 40 CFR §261, Appendix VIII. ICF presents the results of our analysis of Envirocorp's reference molecule approach in Section 1. ICF discusses the feasibility and application of computer model simulations to predict the fate and transport of highly complex waste streams in Section 2.

1.0 EVALUATION OF ENVIROCORP'S REFERENCE MOLECULE APPROACH

ICF evaluated the validity of Envirocorp's reference molecule approach for deriving ad hoc detection limits for constituents that had neither Agency-approved health-based level (HBL) nor Agency-approved surrogate levels (i.e., detection limits or practical quantitation limits). In general, ICF agrees with Envirocorp's reference molecule approach. ICF, however, determined that several of Envirocorp's selected reference molecules did not sufficiently resemble the molecular structure of the constituents in question to provide confidence in obtaining the best ad hoc detection limit. ICF discusses the general strategy used to determine the accuracy of the reference molecule approach and to derive ad hoc detection limits below.

1.1 Identification and Verification of Health-Based Levels

As stipulated by 40 CFR §148.20(a), petitioners must demonstrate that waste constituents will not migrate from the injection zone at hazardous levels. Envirocorp, therefore, used "Concentration Limits Applicable to No-Migration Petitions for Injected Hazardous Wastes," prepared by EPA's Office of Drinking Water, October 1990 (Guidance No. 71) to select HBLs for unit boundary comparisons.

ICF's initial evaluation step consisted of verifying Envirocorp's list of constituents with Agency-approved HBLs and actual levels. ICF, however, recognized that Guidance No. 71 may not contain up-to-date toxicological information. ICF used the following in-house sources both to identify additional constituents with Agency-approved HBLs and to update the constituents and levels cited by Envirocorp:

- "Computer Print-Out of 40 CFR §264, Appendix IX constituents with HBLs," June 1992 (prepared by EPA's Office of Characterization and Assessment);

- "Docket Report of Health-Based Levels and Solubilities Used in the Evaluation of Delisting Petitions, Submitted under 40 CFR §260.20 and §260.22," July 1992 (prepared for the Delisting Section); and,

- "Docket Report of Health-Based Levels and Solubilities for Additional Compounds Used in the Evaluation of Delisting

Petitions, Submitted under 40 CFR §260.20 and §260.22," July 1992 (prepared for the Delisting Section).

ICF also used these sources to reduce the number of constituents not having Agency-approved HBLs, which in turn, reduced the number of constituents needing surrogate levels or ad hoc detection limits. ICF assigned HBLs using the most up-to-date reference, defaulting to the HBL listed in Guidance No. 71 if a more recent value was not available. ICF notes that it was not possible to obtain a complete listing from the Agency's Integrated Risk Information System (IRIS), an on-line computer data base (which is updated monthly), due to the budgetary constraints of this work assignment. ICF presents a comparison of Envirocorp's HBLs and the most up-to-date HBLs in Attachment 1.

ICF notes that Envirocorp used analytical detection limits for constituents classified as "not otherwise specified" (NOS) categories even though individual HBLs were available. Compounds grouped in this category included: dichlorobenzenes, dichlorethylenes, dinitrobenzenes. ICF also notes that the analytical detection limits for these constituents are much lower than the HBL.

1.2 Selection of Surrogate Hazardous Levels

If a particular hazardous constituent does not have an Agency-approved HBL, the petitioner can derive a "case-specific" level based on the methodology contained in RFI Guidance, Interim Final, Section 8 - Health and Environmental Assessment, May 1989. Alternatively, the petitioner can use a surrogate level based on the lowest of either the analytical detection limit listed in Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, (SW-846), third edition, 1986, or the practical quantitation limit cited in 40 CFR §264, Appendix IX. Envirocorp chose to use surrogate levels for the constituents that did not have Agency-approved HBLs.

ICF used SW-846 and 40 CFR §264, Appendix IX to evaluate the detection limits and practical quantitation limits cited by Envirocorp. In most cases, ICF determined that Envirocorp cited the correct detection limit/practical quantitation limit. In a few instances, ICF proposed more appropriate detection limits/practical quantitation limits. ICF presents a comparison of Envirocorp's and ICF's surrogate levels in Attachment 1.

1.3 Evaluation of the Reference Molecule Approach

As discussed in Guidance No. 71, once the petitioner determines that a specific constituent has neither an Agency-approved HBL or surrogate level, the petitioner may

choose to estimate ad hoc detection limits. Envirocorp chose to estimate ad hoc detection limits using their reference molecule approach.

ICF evaluated Envirocorp's reference molecule approach for deriving ad hoc detection levels by assessing and evaluating the molecular structures of the analytes of concern against Envirocorp's proposed reference molecules. ICF's analysis focused on the structure (i.e., straight chain, cyclic, aromatic), functional groups, and molecular size. ICF presents the reference molecule ad hoc detection limits selected by Envirocorp in Attachment 1.

ICF agreed with Envirocorp's selection of reference molecules for all of the constituents, except 22. ICF presents the constituent number (designated by Envirocorp), common constituent name, and Envirocorp's reference molecule for these 22 compounds in Table 1. ICF used the following criteria for selecting more appropriate reference molecules (i.e., molecules that more closely resembled the analyte in question): (1) structural similarity (i.e., straight chain or cyclic); (2) functional group; and (3) listing as an SW-846 analyte. ICF discusses why each of the 22 reference molecules selected by Envirocorp may not be the most appropriate constituents to derive ad hoc detection limits. This discussion, which follows, is organized by compound number.

TABLE 1

Comparison of Reference Molecules Selected by Envirocorp and ICF

NO.	Common Names	Envirocorp's Reference Molecule	ICF Reference Molecule
12	Aflatoxins	Dibenzofuran	None Proposed
19	5-(Aminomethyl)-3-isoxazolol	N-Nitrosopyrrolidine	Phosalone
21	Amitrole	p-Dimethylaminoazobenzene	Triademefon
34	Azaserine	p-Dimethylaminoazobenzene	Pronamide
94	1-(o-Chlorophenyl) thiourea	1-Acetylthiourea	Ethylene Thiourea
109	Cycasin	p-Dimethylaminoazobenzene	N-nitrosodimethylamine
111	Cyclophosphamide	Octamethylpyrophosphoramide	Hexamethyl phosphoramide

TABLE 1 (Continued)

Comparison of Reference Molecules Selected by Envirocorp and ICF

NO.	Common Names	Envirocorp's Reference Molecule	ICF Reference Molecule
162	Diisopropylfluoro-phosphate	Tri-p-tolylphosphate	Phosphamidon
197	Ethylenebisdithio-carbamic acid	Diallate	Ethyl Carbamate
198	Ethylenebisdithio-carbamic acid, salts and esters	Ethyl Carbonate	Ethyl Carbamate
213	Fluoroacetamide	p-Difluorobenzene	Acrylamide
214	Fluoroacetic acid; sodium salt	p-Difluorobenzene	Benzoic Acid
232	Hexaethyl tetraphosphate	Hexamethyl phosphoramide	Tributyl phosphate
302	Nitrogen Mustard	Ethylene Thiourea	Diphenylamine
303	Nitrogen Mustard, hydrochloride salt	Ethylene Thiourea	Diphenylamine
304	Nitrogen Mustard, N-oxide	Ethylene Thiourea	Diphenylamine
305	Nitrogen Mustard, N-oxide, hydrochloride salt	Ethylene Thiourea	Diphenylamine
321	N-Nitrosonornicotine	N-Nitrosodimethylamine	Nicotine
362	Saccharin	Safrole	Ethylene Thiourea
363	Saccharin salts	Safrole	Ethylene Thiourea
404	Thiosemicarbazide	1,2-Diphenylhydrazine	Ethylene Thiourea
420	Trichloromethanethiol	Chloroform	Ethylene Thiourea

Compound 12: *Aflatoxins* are large, biologically active macromolecules (Fig. 1). Envirocorp's reference molecule, *dibenzofuran* (Fig. 2), is a much smaller organic compound that lacks many of the functional groups found in *aflatoxin*, and cannot, therefore, be expected to exhibit the same chemical properties. An examination of EPA's 1988 List of Lists, as well as an independent search of EPA methods indicates that there are no GC or GC/MS methods currently available for the environmental analysis of *aflatoxin* or structurally similar molecules. There are, however, methods available for the analysis of *aflatoxin* in food and animal tissue using High Performance Liquid Chromatography (HPLC). It is possible that these methods could be adapted for use in environmental samples. Information from Supelco, a manufacturer of chromatography supplies, indicates that detection limits of 10 ppb (0.01 mg/L) are achievable.

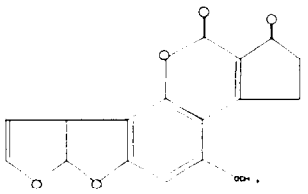

Fig. 1 Aflatoxin B1

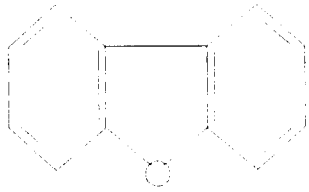

Fig. 2 Dibenzofuran

Compound 19: *5-(Aminomethyl)-3-isoxazolol* (Fig. 3), consists of a five-membered ring containing both nitrogen and oxygen, a carbonyl group, one double bond, and an amino alkyl group attached to one of the carbon atoms. ICF believes that this molecule is quite different from the reference molecule, *n-nitrosopyrrolidine* (Fig. 4), which also has a five-membered ring, but has no oxygen incorporated into it, has an unsaturated ring, and has a nitrogen atom with an NO group attached to it. ICF proposes *phosalone* (Fig. 5) as a better reference molecule. *Phosalone* is a target analyte in SW-846 method 8141 (Determination of Organo-phosphorus Pesticides by Gas Chromatography) with a detection limit of 0.001 mg/L. We believe this compound is more similar structurally than the originally proposed reference molecule, because of the composition of five membered ring. Both *5-(aminomethyl)-3-isoxazolol* and *phosalone* have nitrogen and oxygen atoms incorporated into the ring structure with the doubly bonded oxygen directly attached, whereas *N-nitrosopyrrolidine* lacks the incorporated oxygen atom, and the doubly bonded oxygen atom is attached to an adjacent atom rather than being directly attached to the ring itself.

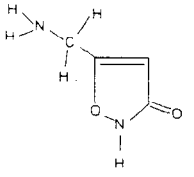

Fig. 3 5-(Aminomethyl)-3-isoxazolol

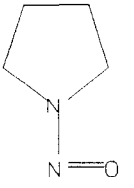

Fig. 4 N-Nitrosopyrrolidine

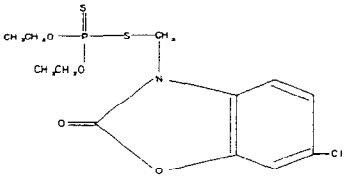

Fig. 5 Phosalone

Compound 21: Structurally, *amitrole* (Fig. 6), bears very little similarity to the reference molecule, *p-dimethylaminoazobenzene* (Fig. 7). *Amitrole* is a five-membered ring containing three nitrogen atoms and two double bonds, with an amino group attached to one of the carbon atoms. The reference molecule is larger, contains two aromatic rings, and none of the nitrogen atoms are found in any cyclic configuration. ICF proposes *triademefon* (Fig. 8) as a reference molecule for *amitrole*. *Triademefon* is a target analyte in EPA method 507 (Determination of Nitrogen and Phosphorus Containing Pesticides by Gas Chromatography). We believe this to be a better match than the reference molecule originally chosen, because *triademefon* contains the identical triazo five membered ring which is entirely lacking in *p-dimethylaminoazobenzene*.

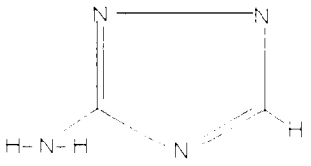

Fig. 6 Amitrole

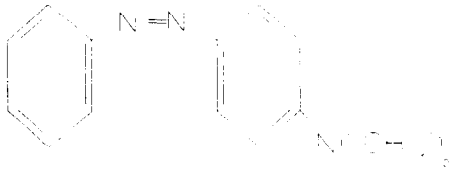

Fig. 7 p-Dimethylaminoazobenzene

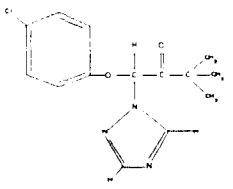

Fig. 8 Triademefon

Compound 34: *Azaserine* (Fig. 9), is a straight chain compound with a carboxylic acid functional group at one end, an N_2 group at the other end, an ester moiety in the middle, and an amino group attached to one of the carbon atoms. ICF believes that *p-dimethylaminoazobenzene* (Fig. 10), whose structure was described above for Compound 21, is an inadequate reference molecule because the molecular structure does not resemble the molecular structure of *azaserine*. *Azaserine* is an azo derivative of the amino acid serine. An exhaustive search of available analytical methods failed to yield amino acid-like compounds. The closest match found by ICF was *pronamide* (Fig. 11). Like *azaserine*, *pronamide* contains a carbonyl group and an amino group in a straight chain configuration. Although not an ideal match, we believe this molecule to be more closely related to azaserine than the originally proposed p-dimethylaminoazobenzene. *Pronamide* is a target analyte in SW-846 method 8270A.

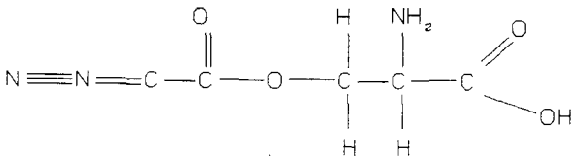

Fig. 9 Azaserine

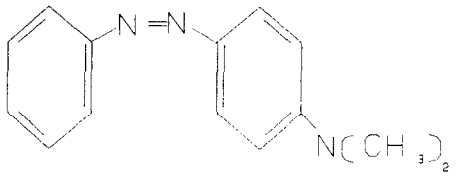

Fig. 10 p-Dimethylaminoazobenzene

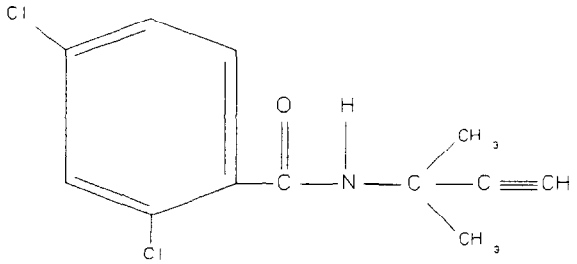

Fig. 11 Pronamide

Compound 94: *1-(o-Chlorophenyl) thiourea* (Fig. 12), and the reference molecule, *1-acetyl thiourea* (Fig. 13), both contain the thiourea functional group, and it is possible that this may be the best choice for a reference molecule, given the limited number of compounds for which an analytical method is available. ICF, however, recommends caution when making health-related decisions based on the comparison of these two molecules. The chemical of interest contains a chlorinated benzene group, whereas the reference molecule contains a simple alkyl aldehyde; therefore, the resulting difference in toxic effects between these two moieties may be significant. ICF recommends *ethylene thiourea* (Fig. 14) as a more appropriate reference molecule. *Ethylene thiourea* and *1-(o-chlorophenyl) thiourea* are cyclic compounds containing sulfur, and nitrogen atoms.

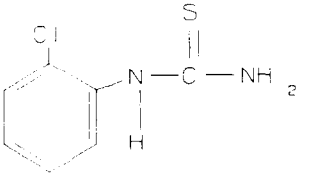

Fig. 12 1-(o-Chlorophenyl) thiourea

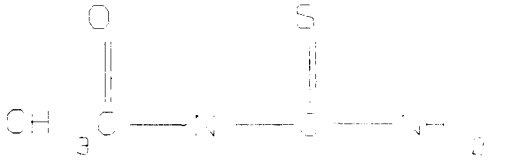

Fig. 13 1-Acetyl thiourea

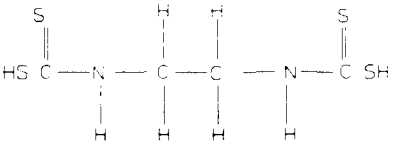

Fig. 14 Ethylene Thiourea

Compound 109: *Cycasin* (Fig. 15), is a naturally occurring molecule comprised of a six-membered, single oxygen-containing, unsaturated ring, with three alcohol, one methanol, and a azoxy methyl group attached to the cyclic carbons. ICF notes that this constituent bears no resemblance to the Envirocorp reference molecule, *p-dimethylaminoazobenzene* (Fig. 16), described above for Compound 21. ICF believes that it is extremely difficult to draw conclusions concerning toxicity or detection limits by comparing these two molecules. ICF recommends *N-nitrosodimethylamine* (Fig. 17) as a more appropriate reference molecule, because it is a nitrosoamine that contains the functional group found in the active component of the cycasin.

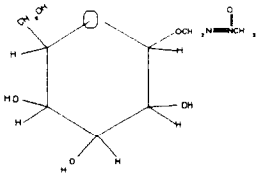

Fig. 15 Cycasin

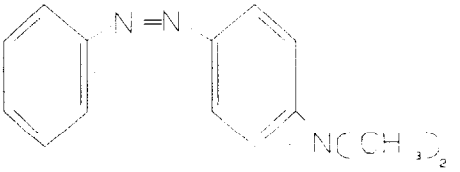

Fig. 16 p-Dimethylaminoazobenzene

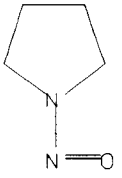

Fig. 17 N-nitrosodimethylamine

Compound 111: *Cyclophosphamide* (Fig. 18), consists of an unsaturated, six-membered ring containing three heteroatoms (phosphorus, nitrogen, and oxygen) with a chlorinated alkyl amine attached to the phosphorus atom. The reference compound, *octamethyl pyrophosphoramide* (Fig. 19), not only lacks the heteroatomic ring structure, but the alkyl amino groups are not halogenated. *Hexamethyl phosphoramide* (Fig. 20), is proposed as a better reference molecule because it and the analyte of concern are functional derivatives of carboxylic acid and semivolatile compounds.

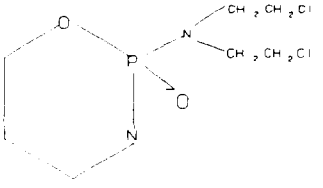

Fig. 18 Cyclophosphamide

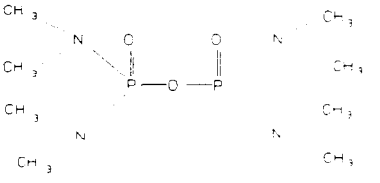

Fig. 19 Octamethyl pyrophosphoramide

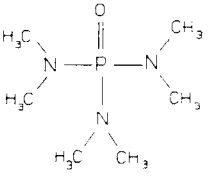

Fig. 20 Hexamethyl phosphoramide

Compound 162: *Diisopropylfluorophosphate* (Fig. 21), consists of a central phosphorus atom to which is attached one doubly bonded oxygen atom, one fluorine atom, and two isopropyl ether groups. The reference molecule, *tri-p-tolyl phosphate* (Fig. 22), contains the central phosphorous atom with doubly bonded oxygen, but the other three groups are p-toluene moieties. The structural dissimilarities (lack of halogen and ether functionalities) are strong enough to make a direct comparison difficult. ICF notes that the chemical of interest is highly soluble in water, however, the reference molecule is not. A possible alternative reference molecule could be *phosphamidon* (Fig. 23), which like the chemical of interest, contains the phosphorous with doubly bonded oxygen and two alkyl ether groups. This molecule also lacks the direct halogenation, but the final group attached to the phosphorous does contain a chlorine atom. ICF notes that the detection limit for *phosphamidon* using 8270 is 10^{-1} mg/L, which is an order of magnitude higher than that of *tri-p-tolylphosphate*.

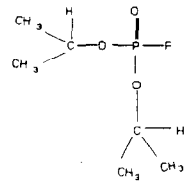

Fig. 21 Diisopropylfluorophosphate

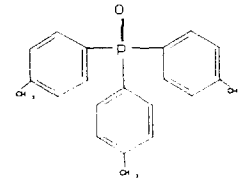

Fig. 22 Tri-p-tolyl phosphate

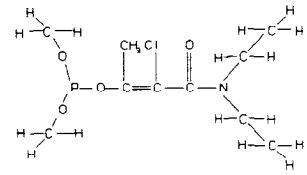

Fig. 23 Phosphamidon

Compound 197: *Ethylenebisdithiocarbamic acid* (Fig. 24), and the reference molecule, *diallate* (Fig. 25), differ greatly in structure. The chemical of interest contains two dithiocarbamic acid groups, diallate has none. The reference molecule is halogenated and contains unsaturated carbons, whereas the carbamic acid does not. ICF notes that, although it is probable for both molecules to be detected using method 8270, it is not possible to predict the detection limit of either with any certainty. ICF believes that *ethyl carbamate* (Fig. 26), whose primary variation from the molecule of interest is the substitution of oxygen atoms for sulfur atoms, would be a better reference molecule.

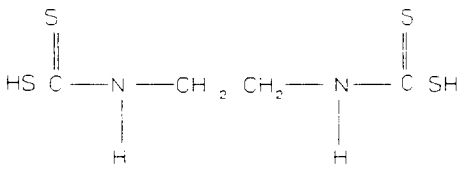

Fig. 24 Ethylenebisdithiocarbamic acid

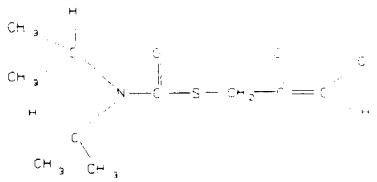

Fig. 25 Diallate

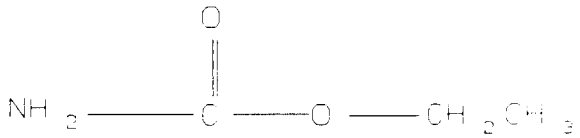

Fig. 26 Ethyl carbamate

Compound 198: An example of *Ethylenebisdithiocarbamic acid*, salts and esters is provided in Fig. 27. Envirocorp's reference molecule is *ethyl carbonate* (Fig. 28). ICF, however, believes that *ethyl carbamate* (Fig. 29), is more structurally similar to the chemical of interest, which makes it a better reference molecule.

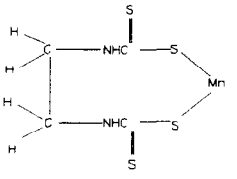

Fig. 27 Ethylenebisdithiocarbamic acid, Manganous salt

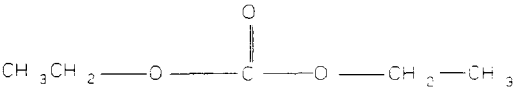

Fig. 28 Ethyl carbonate

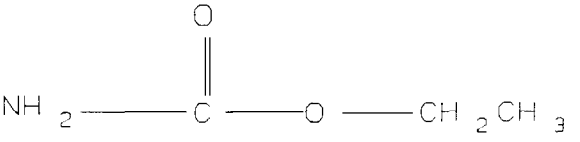

Fig. 29 Ethyl carbamate

Compound 213: The only similarity between *fluoroacetamide* (Fig. 30), and the Envirocorp reference molecule, *1,4-difluorobenzene* (Fig. 31), is that both molecules contain a fluorine atom. As a result, ICF is unable to conclude whether similar detection limits are achievable. *Fluoroacetamide* and the ICF proposed reference molecule *acrylamide* (Fig. 32), are both derivatives of acetamide, and therefore should behave similarly.

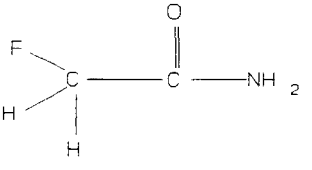

Fig. 30 Fluoroacetamide

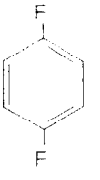

Fig. 31 1,4-Difluorobenzene

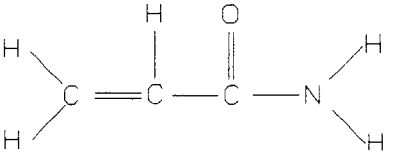

Fig. 32 Acrylamide

Compound 214: The only similarity between the sodium *salt of fluoroacetic acid* (Fig. 33), and Envirocorp's reference molecule, *1,4-difluorobenzene* (Fig. 34), is that both molecules contain a fluorine atom. The sodium salt of fluoroacetic acid and the ICF proposed reference molecule, *benzoic acid* (Fig. 35), are both carboxylic acids. Since the properties of the carboxyl group is essentially the same regardless of what is attached to it, ICF believes that *benzoic acid* is a more appropriate reference molecule.

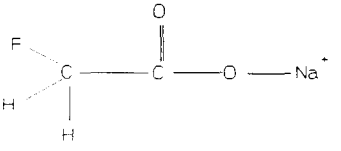

Fig. 33 **Fluoroacetic acid, salt**

Fig. 34 **1,4-Difluorobenzene**

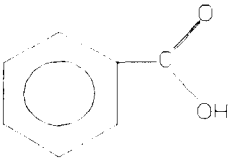

Fig. 35 **Benzoic acid**

Compound 232: *Hexaethyl tetraphosphate* (Fig. 36), is an ester functional derivative of carboxylic acids, containing carbon, hydrogen, phosphorus, and oxygen atoms. Envirocorp's reference molecule *hexamethyl phosphoramide* (Fig. 37), is an amide functional derivative of carboxylic acids, containing carbon, hydrogen, phosphorus, oxygen, and nitrogen atoms. ICF believes that *tributyl phosphate* (Fig. 38), which, like the chemical of interest, is also an ester functional derivative of carboxylic acid, is a more acceptable reference molecule.

Fig. 36 **Hexaethyl tetraphosphate**

Fig. 37 **Hexamethyl phosphoramide**

Fig. 38 **Tributyl phosphate**

Compounds 302, 303, 304, 305: *Nitrogen mustard and its derivatives* (Fig. 39), is an open chain amine with a chlorinated alkyl group on each side of the nitrogen atom and a methyl group attached to the nitrogen atom. Envirocorp's reference molecule, *ethylene thiourea* (Fig. 40), is a closed chain functional derivative of carboxylic acids containing a sulfur atom. The presence of a sulfur atom in the chemical structure of *ethylene thiourea* may make this an unacceptable reference molecule. ICF believes that *diphenylamine* (Fig. 41), which is an amine with an aryl group attached to the nitrogen atom, may be a more acceptable reference molecule.

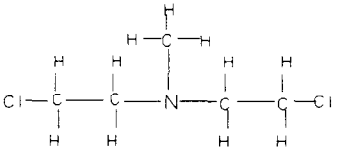

Fig. 39 Nitrogen Mustard

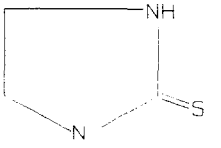

Fig. 40 Ethylene thiourea

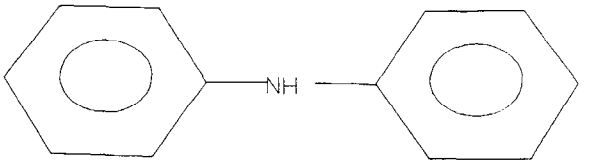

Fig. 41 *Diphenylamine*

Compound 321: *N-Nitrosonornicotine (Fig. 42)*, has both a ring and a closed chain structure. *N-Nitrosonornicotine* is also a derivative of nicotine. *N-Nitrosodimethylamine* (Fig. 43), Envirocorp's choice for a reference molecule is an open chain amine compound. ICF believes that *nicotine* (Fig. 44), may be a more appropriate reference molecule.

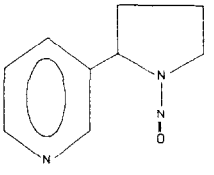

Fig. 42 Nitrosonornicotine

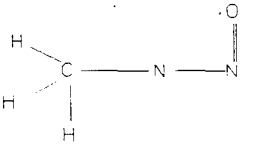

Fig. 43 N-Nitrosodimethylamine

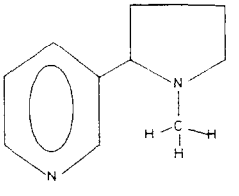

Fig. 44 Nicotine

Compounds 362 and 363: Saccharin (Fig. 45), is a ring structure that contains sulfur, oxygen, and nitrogen atoms. *Safrole* (Fig. 46), Envirocorp's reference molecule for *Saccharin and its salt*, may not be an acceptable reference molecule because it is an aromatic phenol compound that does not contain a sulfur atom. ICF believes that *ethylene thiourea* (Fig. 47), may be a more acceptable reference molecule because it is a closed chain structure that contains sulfur and nitrogen atoms and is detectable using SW-846 test methods.

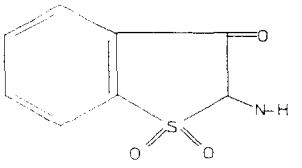

Fig. 45 Saccharin

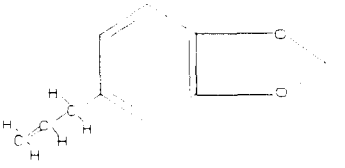

Fig. 46 Safrole

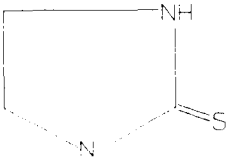

Fig. 47 Ethylene thiourea

Compound 404: *Thiosemicarbazide* (Fig. 48), is an open chain compound containing a sulfur-nitrogen and sulfur-carbon bond. Envirocorp's reference molecule, *1,2-diphenylhydrazine* (Fig. 49), does not contain a sulfur atom. ICF believes that *ethylene thiourea* (Fig. 50), which is a closed chain structure that contains sulfur and nitrogen atoms, may be a better reference molecule because *ethylene thiourea* is more similar in molecular structure and is detectable using SW-846 test methods.

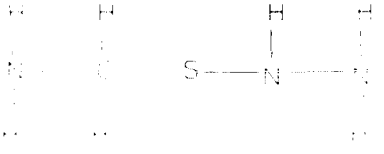

Fig. 48 Thiosemicarbazide

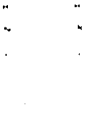

Fig. 49 1,2-Diphenylhydrazine

Fig. 50 Ethylene thiourea

Compound 420: *Trichloromethanethiol* (Fig. 51), is an open chain compound containing a trichloromethane group attached to a sulfur atom. Envirocorp's reference molecule, *chloroform* (Fig. 52), is a trichlorinated methane compound. *Ethylene thiourea* (Fig. 53), is a closed chain structure that contains sulfur and nitrogen atoms. ICF believes that *ethylene thiourea* is more similar in molecular structure, and therefore, is a more appropriate reference molecule.

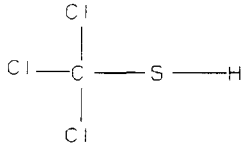

Fig. 51 Trichloromethanethiol

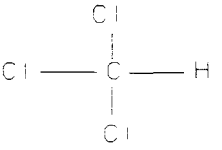

Fig. 52 Chloroform

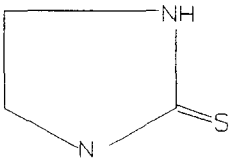

Fig. 53 Ethylene thiourea

1.4 Conclusions

Envirocorp's reference molecule approach is scientifically valid for deriving ad hoc detection limits for constituents that do not have Agency-approved HBLs or Agency-approved surrogate levels. As noted above, ICF agreed with all but 22 of Envirocorp's selected reference molecules. ICF has proposed alternative reference molecules for all 22 compounds with the exception of aflatoxin. An extensive evaluation of this constituent indicates that GC/MS is not the appropriate analytical methodology for identification of this constituent. ICF suggests that high pressure liquid chromatography be used for the determination of this macromolecule. Lastly, the results of Envirocorp's reference molecule analysis, can be used in conjunction with the most recent toxicological information contained in EPA's Integrated Risk Information System (IRIS) data base to update Guidance No. 71.

1.5 Recommendations for Follow-up Work

ICF recommends the following steps be taken to enhance the accuracy of Envirocorp's proposed reference molecule approach for determining the ad hoc detection limits:

- Although dichloroisopropyl ether and chloroacetaldehyde were selected by Envirocorp as reference molecules, these constituents are not included in SW-846. ICF suggests that Envirocorp only select reference molecules that are included in SW-846.

- Several compounds are naturally occurring constituents, e.g., aflatoxin and cycasin. An evaluation of the literature suggests that a High Performance Liquid Chromatography method may be a better analytical methodology. Additional information should be collected to determine the feasibility of using this technique.

- OGWDW should obtain a report of all the HBLs currently available from IRIS. The information contained in IRIS and in Attachment 1 should be used to update Guidance No. 71.

- OGWDW should consider allowing other Offices within the Agency to review the updated Guidance No. 71, prior to distributing the document to petitioners, due to the potential ramifications of this document on other Agency programs.

- The detection limits cited in Attachment 1 are obtainable using standard SW-846 test methods. OGWDW should determine whether petitioners need to undertake "heroic" analytical efforts to obtain the lowest possible surrogate levels.

- EPA should perform a method detection limit study to verify the accuracy of the ad hoc detection limits.

2.0 FEASIBILITY AND APPLICATION OF NUMERICAL SIMULATION OF FATE AND TRANSPORT OF HIGHLY COMPLEX WASTES IN DEEP INJECTION ZONES

ICF assessed the feasibility and application of computer model simulation to predict the fate and transport of a highly complex mixture of organic and inorganic wastes within the injection zone (aquifer). ICF notes that both flow and transport (advection-dispersion) and geochemical models have been utilized to predict fate and transport of hazardous constituents within an injection zone. These models also have been used to demonstrate, with a reasonable degree of certainty, that there will be no migration of hazardous constituents from the injection zone for as long as the waste remains hazardous. ICF presents a brief discussion of why numerical simulation models are necessary for no-migration demonstrations below. ICF also presents a general discussion of the processes that must be considered when evaluating the utility of numerical simulation models below.

In order to obtain a no-migration exemption, petitioners must demonstrate that, to a reasonable degree of certainty, there will be no migration of hazardous constituents from the injection zone for as long as the waste remains hazardous (i.e., up to 10,000 years). This demonstration can be made in either of two ways. First, petitioners can demonstrate, using flow and transport models, that the injected fluids will not migrate vertically out of the injection zone, or laterally to a point of discharge or interface with an underground source of drinking water (USDW). Second, petitioners can use geochemical modeling to demonstrate that the waste is transformed in such a manner that it becomes non-hazardous within the injection zone. Both methods require the comparison of the predicted injection zone boundary concentrations to the appropriate HBLs.

2.1 Processes in Subsurface Migration

The major processes that affect fluid migration within the injection zone are:

- Advection, which arises due to the difference in heads between the injection and in-situ fluids;
- Dispersion, due to the phenomenon of different contaminant particles flowing at different velocities within the tortuous porous medium;
- Diffusion, due to the concentration gradient of the contaminant;
- Adsorption of contaminant particles on the porous surface during transport;

- Chemical/geochemical reactions among various chemicals and with the formation.

Numerical simulation models attempt to account for each of these major processes in order to predict flow and transport of the constituent of interest. ICF cautions that any model only is as good as both the equations describing flow and transport and the chemical-specific and site-specific input data.

Equations describing *advection* and *dispersion* of subsurface fluids are well established in the literature. ICF notes, however, that aquifers are not homogeneous in most cases and the geology of the site is not known in detail; therefore, exact analytical or numerical solutions of the above equations are difficult to obtain in practical cases. ICF also notes that the solution of the dispersion equation exhibits an asymptotic decline in waste concentration away from the well bore; therefore, the ultimate plume radius may be enhanced by a factor of two or more, depending on a variety of chemical-, and site-specific factors. Combined advection-dispersion equations also assume that the chemical constituent is non-reactive in order to estimate the travel time and its concentration at any point. Advection-dispersion equations are based on the presumption that the maximum transport velocity is obtained, and therefore, are used to provide an upper bound prediction of constituent migration.

Diffusion is a very slow process occurring over a relatively long period of time and is only apparent when advection is not dominant. Diffusion is found to be important in modeling a long-term migration scenario following the cessation of active injection, and more so when the base of the USDW and the top of the injection zone are separated by a relatively short distance. *Adsorption* is known to retard the migration of the subsurface plume but very limited data are available to demonstrate its effect on the containment of the injected waste with a reasonable degree of certainty.

In many cases, *chemical and geochemical* reactions are known to retard plume migration and/or render the plume non-hazardous: A prime example, is the injection of highly acidic waste fluid into a carbonate formation. Due to the acid-rock reaction, the plume is rendered non-hazardous (pH > two) within a relatively short distance (two - five feet) from the well bore. In certain cases, where the chemical/geochemical reactions are sufficiently rapid to render the waste non-hazardous in a very short period of time, rigorous analysis of the long-term migration of the injected fluid may be unnecessary.

2.2 Flow and Transport Modeling

Models predicting subsurface fluid flow are well recognized and virtually all no-migration petitions incorporate an analytical, semi-analytical or numerical analysis predicting fluid migration based on advection. The more realistic models utilize a synergistic approach where the phenomena of advection (flow) and dispersion (transport) are coupled. The operators of Class I wells utilize a wide range of mathematical models to predict subsurface waste migration during the active and post-injection periods. The models range from simple analytical solutions of fluid flow in a supposedly homogeneous media to highly involved numerical schemes for coupled equations of fluid flow, transport, adsorption, density variation, and temperature in complex geologic settings.

2.3 Geochemical Modeling

Researchers began using geochemical models to simulate fate and transport processes in the 1960's. The use of geochemical models increased as more complete thermodynamic data bases were developed. Thermodynamic data bases permit the calculation of fluid/mineral equilibria and water/rock reactions in multicomponent systems under the conditions of elevated temperature and pressure present in deep aquifers. Unfortunately, the thermochemical data necessary to run geochemical models are generally sparse and has limited the numerical simulation of subsurface waste reactions. For example, little work has been done on the calculation of organic transformation and organic waste/rock reactions in the subsurface, particularly on the complex organic-inorganic waste streams injected in commercial Class I wells.

Geochemical modeling of chemical transformations occurring in solution and fluid/mineral reactions do not consider adsorption reactions or biological transformations. Both of these processes, however, are important in the degradation and attenuation of hazardous constituents. As a result, the inability of geochemical models to consider these processes is an important limitation. In addition, geochemical modeling of subsurface waste transformations and waste/rock reactions for complex inorganic and organic waste streams has not been verified. Nonetheless, these models may be valuable in predicting waste transformations, as evidenced by their ability to simulate experimental results and to predict reaction rates found in natural systems. The lack of thermochemical data necessary for calculating the reaction kinetics of a highly complex waste, however, precludes widespread use of reaction codes.

In summary, the major processes that can reduce the concentrations of hazardous compounds that are disposed by deep well injection include: microbial activity, sorption,

hydrolysis, oxidation, and chemical interaction. Computer codes available in the public domain for calculating inorganic chemical equilibria and fluid/mineral reactions include EQ3/6; however, they are difficult to use, the thermochemical data base for some elements is inadequate, and rate and sorption processes are not considered. Another computer code for calculating subsurface waste reactions, ECES, has been developed by DuPont. This code is described as an electrolyte solution equilibrium program with kinetics and flow; however, this code is proprietary and cannot be verified independently.

2.4 Use of Reference Molecules in Modeling

Organic compounds may be separated into their primary functional groups because compounds within the same functional group generally: (1) have similar chemical properties; (2) behave similarly in chemical reactions; and, (3) often exhibit a gradation in physical properties with increasing molecular weight. In some cases, these functional groups can be further subdivided into structural groups when the molecule attached to the functional group influences reaction rates. ICF cautions that the functional group driving the selection of the reference molecule may not be the same functional group that influences the geochemical reactions of the constituent within the injection formation. Additional investigation, therefore, is needed to determine how the reference molecule selected for derivation of the ad hoc detection limit will affect the reaction rate of the individual constituent and impacts the overall degradation and transformation processes.

2.5 Conclusions

Both flow and transport (advection-dispersion) and geochemical models have been utilized to predict fate and transport of hazardous constituents within an injection zone. These models also have been used to demonstrate, with a reasonable degree of certainty, that there will be no migration of hazardous constituents from the injection zone for as long as the waste remains hazardous. Geochemical models, however, are not as widely used as flow and transport models to demonstrate no migration due to the lack of thermodynamic data bases, proprietary codes, etc., for modeling a complex mixture of organic and inorganic wastes.

ICF lists some of the concerns relating to modeling the fate and transport of a highly complex mixture of organic and inorganic wastes within a deep injection zone below:

- Combined advection-dispersion equations assume that the chemical constituent is non-reactive in order to estimate the travel time and its concentration at any point.

Advection-dispersion equations are used to generate worst-case scenarios and bound the extent of the waste, on the presumption that the maximum transport velocity is obtained.

- Most chemical substances move through the subsurface not as ideal, non-reactive substances. Chemical substances typically are impacted by biological and/or chemical processes, that in turn affect chemical mobility.

- The physical-chemical interactions include alterations in the chemical or electronic configuration of an element or molecule; alterations in nuclear composition; the establishment of new associations with other chemical species; and interactions with solid surfaces. All of these interactions/processes need to be investigated at depth. Otherwise, predictions from such models will be incorrect. For example, non-linearity of the sorption behavior and time dependency of the sorption process has largely been ignored. To resolve the discrepancy between predicted and actual transport, most practitioners arbitrarily adjust some other poorly characterized model parameter (e.g., dispersion). Again, this leads to erroneous predictions on waste transport and mobility.

In summary, flow and transport models are better understood and more widely used than geochemical models. However, in either case, it is critically important to evaluate all aspects of deep well injection and the physical, chemical, and biological processes that take place in the injection zone and overlying confining zone. This becomes even more important when evaluating fate and transport in a commercial Class I injection well accepting a complex and varied mixture of organic and inorganic wastes.

2.6 Recommendations for Follow-up Work

ICF notes that budgetary constraints imposed on this work assignment make it impossible to do a rigorous assessment of ultimate fate and transport of the petitioner's injected wastes. In addition, the no migration demonstration (utilizing a flow and transport model) that was submitted to EPA by the petitioner was not available for review. As a

result, ICF recommends that OGWDW consider performing the following tasks prior to determining that GNI Group, Inc./Disposal Systems Inc. (or any other petitioner) can model the fate and transport of a highly complex waste stream:

- Review the petitioner's modeling strategy that predicted the pressure buildup and waste movement within the injection zone.

- Evaluate the past operating history (pressures, rates, temperature, etc.); site-specific and regional geology; well construction and monitoring; mechanical integrity; waste compatibility with downhole tubulars; and in-situ fluids and rock and interactions to better understand fate and transport processes in deep aquifers. For example, data on pressure fall-off tests in conjunction with mechanical integrity tests need to be evaluated to confirm model predictions with observed pressures (the petitioner's current permit requires these tests on an annual basis). These data will provide monitoring information on aquifer system performance, waste transformations, and unexpected reactions that can be used to corroborate theoretical predictions.

- Obtain and evaluate waste characterization data. Waste streams injected into a commercial Class I well are extremely variable (depending on which generator's wastes are currently being injected); therefore, waste characterization information is necessary to predict degradation reactions and to evaluate compatibility with the injection and confining zones, the well(s) and, the host rock/fluid.

Finally, ICF cautions that it is critically important to integrate all of the above data with the fate and transport assessment in order to obtain a clearer picture of hazardous waste transformations within a deep injection zone.

ATTACHMENT 1

Evaluation of Envirocorp Inc.'s HBLs and Detection Limits (Based on Reference Molecule Approach)

No.	CAS No.	Chemical Name	Reference Molecule	Envirocorp's HBL (mg/L)	USEPA/CAD's HBL (mg/L) 1/	Envirocorp's Detection Limit (mg/L)	ICF's Detection Limit (mg/L)	SW-846 Analytical Test Method
1	83-32-9	Acenaphthene		-	$2.0 \times 10^{+0}$	1.0×10^{-2}	1.0×10^{-2}	8270
2	208-96-8	Acenaphthylene		-	-	1.0×10^{-2}	1.0×10^{-2}	8270
3	75-05-8	Acetonitrile		2.0×10^{-1}	2.0×10^{-1}	-	-	-
4	67-64-1	Acetone		$4.0 \times 10^{+0}$	$4.0 \times 10^{+0}$	-	-	-
5	98-86-2	Acetophenone		$4.0 \times 10^{+0}$	$4.0 \times 10^{+0}$	-	-	-
6	53-96-3	2-Acetylaminofluorene		-	-	1.0×10^{-2}	2.0×10^{-2}	8270
7	75-36-5	Acetyl chloride	Vinyl Chloride	-	-	2.0×10^{-3}	1.0×10^{-2}	8240
8	591-08-2	1-Acetyl-2-thiourea		-	-	1.0×10^{-2}	$1.0 \times 10^{+0}$	8270
9	107-02-8	Acrolein		-	7.0×10^{-1}	5.0×10^{-3}	5.0×10^{-3}	8240
10	79-06-1	Acrylamide		9.0×10^{-6}	9.0×10^{-6} a	-	-	-
11	107-13-1	Acrylonitrile		7.0×10^{-5}	6.0×10^{-5}	-	-	-
12	1402-68-2	Aflatoxin		-	-	1.0×10^{-2}	1.0×10^{-2}	HPLC**
13	116-06-3	Aldicarb		1.0×10^{-2}	3.0×10^{-3} b	-	-	-
14	309-00-02	Aldrin		2.0×10^{-6}	2.0×10^{-6}	-	-	-
15	107-18-6	Allyl alcohol		2.0×10^{-1}	2.0×10^{-1} b	-	-	-
16	107-05-1	Allyl chloride		-	-	5.0×10^{-3}	5.0×10^{-3}	8240
17	20859-73-8	Aluminum phosphide		1.0×10^{-2}	1.0×10^{-2} a	-	-	-
18	92-67-1	4-Aminobiphenyl		-	-	1.0×10^{-2}	2.0×10^{-2}	8270
19	2763-96-4	5-(Aminomethyl)-3-isoxazolol	Phosalone *	-	-	1.0×10^{-2}	4.0×10^{-2}	8270
20	504-24-5	4-Aminopyridine	Pyridine	-	7.0×10^{-4} b	5.0×10^{-3}	5.0×10^{-3}	8240

ATTACHMENT 1 (Continued)

Evaluation of Envirocorp Inc.'s HBLs and Detection Limits (Based on Reference Molecule Approach)

No	CAS No	Chemical Name	Reference Molecule	Envirocorp's HBL (mg/L)	USEPA/CAD's HBL (mg/L) 1/	Envirocorp's Detection Limit (mg/L)	ICF's Detection Limit (mg/L)	SW-846 Analytical Test Method
21	61-82-5	Amitrole	Triademefon *	-	8.0×10^{-5} b	1.0×10^{-2}	1.0×10^{-2}	8270
22	7803-55-6	Ammonium vanadate	Vanadium	-	-	4.0×10^{-2}	4.0×10^{-2}	7911
23	62-53-3	Aniline		1.0×10^{-2}	6.0×10^{-3}	-	-	-
24	120-12-7	Anthracene		-	$1.0 \times 10^{+1}$	1.0×10^{-2}	1.0×10^{-2}	8270
25	7440-36-0	Antimony		1.0×10^{-2}	6.0×10^{-3}	-	-	-
26		Antimony and compounds N.O.S.		1.0×10^{-2}	6.0×10^{-3} d	-	-	-
27	140-57-8	Aramite		-	1.0×10^{-3}	1.0×10^{-2}	2.0×10^{-2}	8270
28	7440-38-2	Arsenic		5.0×10^{-2}	5.0×10^{-2}	-	-	-
29		Arsenic and compounds N.O.S.		5.0×10^{-2}	5.0×10^{-2} d	-	-	-
30	7778-39-4	Arsenic acid	Arsenic	-	-	1.0×10^{-2}	1.0×10^{-2}	7060
31	1303-28-2	Arsenic pentoxide	Arsenic	-	-	1.0×10^{-2}	1.0×10^{-2}	7060
32	1327-53-3	Arsenic trioxide	Arsenic	-	-	1.0×10^{-2}	1.0×10^{-2}	7060
33	492-80-5	Auramine	4,4-Oxydianiline	-	4.0×10^{-4} b	1.0×10^{-2}	2.0×10^{-2}	8270
34	115-02-6	Azaserine	Pronamide *	-	-	1.0×10^{-2}	1.0×10^{-2}	8270
35	7440-39-3	Barium and barium compounds		$1.0 \times 10^{+0}$	$2.0 \times 10^{+0}$	-	-	-
36	542-62-1	Barium cyanide		$2.0 \times 10^{+0}$	$2.0 \times 10^{+0}$ a	-	-	-
37	225-51-4	Benz[c]acridine	Dibenz[a,j]acridine	-	-	1.0×10^{-2}	1.0×10^{-2}	8270
38	56-55-3	Benz[a]anthracene		1.0×10^{-5}	1.0×10^{-4}	-	-	-

ATTACHMENT 1 (Continued)

Evaluation of Envirocorp Inc.'s HBLs and Detection Limits (Based on Reference Molecule Approach)

No.	CAS No.	Chemical Name	Reference Molecule	Envirocorp's HBL (mg/L)	USEPA/CAD's HBL (mg/L) 1/	Envirocorp's Detection Limit (mg/L)	ICF's Detection Limit (mg/L)	SW-846 Analytical Test Method
39	98-87-3	Benzal chloride	Benzotrichloride	-	-	1.0×10^{-2}	1.0×10^{-2}	8250
40	71-43-2	Benzene		5.0×10^{-3}	5.0×10^{-3}	-	-	-
41	98-05-5	Benzenearsonic acid	Arsenic	-	-	1.0×10^{-2}	1.0×10^{-2}	7060
42	92-87-5	Benzidine		2.0×10^{-7}	2.0×10^{-7} c	-	-	-
43	205-99-2	Benzo[b]fluoranthene		-	2.0×10^{-4}	1.8×10^{-5}	1.8×10^{-5}	8310
44	205-82-3	Benzo[j]fluoranthene		-	-	1.8×10^{-5}	1.8×10^{-5}	8310
45	207-08-9	Benzo[k]fluoranthene	Benzo[b]fluoranthene	-	2.0×10^{-4}	1.7×10^{-5}	1.7×10^{-5}	8310
46	50-32-8	Benzo[a]pyrene		3.0×10^{-6}	2.0×10^{-4}	-	-	-
47	106-51-4	p-Benzoquinone		-	-	1.0×10^{-2}	1.0×10^{-2}	8270
48	98-07-7	Benzotrichloride		-	3.0×10^{-6} b	1.0×10^{-2}	1.0×10^{-2}	8250
49	100-44-7	Benzyl chloride		-	2.0×10^{-4} c	5.0×10^{-3}	1.0×10^{-1}	8240
50	100-51-6	Benzyl alcohol		-	$1.0 \times 10^{+1}$	2.0×10^{-2}	2.0×10^{-2}	8270
51	7440-41-7	Beryllium		7.0×10^{-6}	4.0×10^{-3}	-	-	-
52		Beryllium and compounds N.O.S.		7.0×10^{-6}	4.0×10^{-3} d	-	-	-
53	111-91-1	Bis (2-chloroethyoxy) methane 2/		-	-	1.0×10^{-2}	1.0×10^{-2}	8270
54	108-60-1	Bis (2 chloro-1-methylethyl) ether 3/	2,2' Dichloroisopropyl ether	-	5.0×10^{-4} c	1.0×10^{-2}	1.0×10^{-2}	8270
55A	319-84-6	alpha BHC		-	6.0×10^{-6}	5.0×10^{-5}	5.0×10^{-5}	8080
55B	319-85-7	beta BHC		-	2.0×10^{-5}	5.0×10^{-5}	5.0×10^{-5}	8080
55C	319-86-8	delta BHC		-	-	1.0×10^{-4}	1.0×10^{-4}	8080
56	598-31-2	Bromoacetone		-	-	5.0×10^{-3}	5.0×10^{-3}	8240

ATTACHMENT 1 (Continued)

Evaluation of Envirocorp Inc.'s HBLs and Detection Limits (Based on Reference Molecule Approach)

No	CAS No	Chemical Name	Reference Molecule	Envirocorp's HBL (mg/L)	USEPA/CAD's HBL (mg/L) 1/	Envirocorp's Detection Limit (mg/L)	ICF's Detection Limit (mg/L)	SW-846 Analytical Test Method
57	75-27-4	Bromodichloromethane		7.0×10^{-1}	3.0×10^{-4}	-	-	-
58	75-25-2	Bromoform		7.0×10^{-1}	4.0×10^{-3}	-	-	-
59	101-55-3	4-Bromophenyl phenyl ether		-	-	1.0×10^{-2}	1.0×10^{-2}	8270
60	357-57-3	Brucine	Strychnine	-	-	1.0×10^{-2}	4.0×10^{-2}	8270
61	85-68-7	Butyl benzyl phthalate		-	1.0×10^{-1}	5.0×10^{-3}	5.0×10^{-3}	8060
62	75-60-5	Cacodylic acid {Dimethyl arsenic acid}	Arsenic	-	1.0×10^{-1} b	1.0×10^{-2}	1.0×10^{-2}	7060
63	7440-43-9	Cadmium		1.0×10^{-2}	5.0×10^{-3}	-	-	-
64		Cadmium and compounds N.O.S.		1.0×10^{-2}	5.0×10^{-3} d	-	-	-
65	13765-19-0	Calcium chromate	Chromium	-		1.0×10^{-2}	1.0×10^{-2}	7191
66	592-01-8	Calcium cyanide		$1.0 \times 10^{+0}$	$1.0 \times 10^{+0}$ a	-	-	-
67	75-15-0	Carbon disulfide		$4.0 \times 10^{+0}$	$4.0 \times 10^{+0}$	-	-	-
68	353-50-4	Carbon oxyfluor	Dichlorodifluoro methane	-	-	5.0×10^{-3}	5.0×10^{-3}	8240
69	56-23-5	Carbon tetrachloride		5.0×10^{-3}	5.0×10^{-3}	-	-	-
70	75-87-6	Chloral	Chloroacetaldehyde	-	7.0×10^{-2} b	5.0×10^{-3}	NA	8240
71	305-03-3	Chlorambucil	5-Chloro-2 Methylaniline	-	7.0×10^{-6} b	1.0×10^{-2}	1.0×10^{-2}	8270
72	57-74-9	Chlordane		3.0×10^{-5}	2.0×10^{-3}	-	-	-
73		Chlordane (alpha and gamma isomers)	Chlordane	-	-	1.0×10^{-4}	1.0×10^{-4}	8080
74		Chlorinated benzenes, N.O.S. [1]	Chlorobenzene	-	-	2.0×10^{-3}	2.0×10^{-3}	8010
75		Chlorinated ethane, N.O.S. [1]	1,2 Dichloroethane	-	-	5.0×10^{-4}	5.0×10^{-4}	8010
76		Chlorinated fluorocarbons, N.O.S. [1]	Dichlorodifluoromethane	-	-	5.0×10^{-3}	5.0×10^{-3}	8240

ATTACHMENT 1 (Continued)

Evaluation of Envirocorp Inc.'s HBLs and Detection Limits (Based on Reference Molecule Approach)

No.	CAS No.	Chemical Name	Reference Molecule	Envirocorp's HBL (mg/L)	USEPA/CAD's HBL (mg/L) 1/	Envirocorp's Detection Limit (mg/L)	ICF's Detection Limit (mg/L)	SW-846 Analytical Test Method
77		Chlorinated naphthalene, N.O.S. [1]	2 Chloronaphthalene	-	-	1.0×10^{-2}	1.0×10^{-2}	8270
78		Chlorinated phenol, N.O.S. [1]	2 Chlorophenol	-	-	5.0×10^{-3}	5.0×10^{-3}	8040
79	494-03-1	Chlornaphazine	1 Naphthylamine	-	-	1.0×10^{-2}	1.0×10^{-2}	8270
80	107-20-0	Chloroacetaldehyde		-	-	5.0×10^{-3}	NA	8240
81		Chloroalkyl ethers, N.O.S. [1]	2 Chloroethyl ether	-	-	1.0×10^{-2}	1.0×10^{-2}	8270
82	106-47-8	p-Chloroaniline		-	1.0×10^{-1}	2.0×10^{-2}	2.0×10^{-2}	8270
83	108-90-7	Chlorobenzene		1.0×10^{-1}	1.0×10^{-1}	-	-	-
84	510-15-6	Chlorobenzilate		-	7.0×10^{-1}	1.0×10^{-2}	1.0×10^{-2}	8270
85	59-50-7	p-Chloro-m-cresol		-	-	5.0×10^{-3}	5.0×10^{-3}	8040
86	124-48-1	Chlorodibromomethane (Dibromochloromethane)	Dibromochloromethane	-	4.0×10^{-4}	1.0×10^{-3}	1.0×10^{-3}	8010
87	75-00-3	Chloroethane		-	-	5.0×10^{-3}	5.0×10^{-3}	8010
88	110-75-8	2-Chloroethyl vinyl ether		-	-	5.0×10^{-3}	1.0×10^{-2}	8240
89	67-66-3	Chloroform		6.0×10^{-3}	6.0×10^{-3}	-	-	-
90	107-30-2	Chloromethyl methyl ether		4.0×10^{-6}	4.0×10^{-6} b	-	-	-
91	91-58-7	beta-Chloronaphthalene (2-Chloronaphthalene)	2-Chloronaphthalene	-	$3.0 \times 10^{+0}$	1.0×10^{-2}	1.0×10^{-2}	8270
92	95-57-8	o-Chlorophenol (2-Chlorophenol)	2-Chlorophenol	-	2.0×10^{-1}	5.0×10^{-3}	5.0×10^{-3}	8040
93	7005-72-3	4 Chlorophenyl phenyl ether		-	-	1.0×10^{-2}	1.0×10^{-2}	8270
94	5344-82-1	1-(o-Chlorophenyl) thiourea	Ethylene Thiourea *	-	-	1.0×10^{-2}	$1.0 \times 10^{+0}$	8270

ATTACHMENT 1 (Continued)

Evaluation of Envirocorp Inc.'s HBLs and Detection Limits (Based on Reference Molecule Approach)

No	CAS No	Chemical Name	Reference Molecule	Envirocorp's HBL (mg/L)	USEPA/CAD's HBL (mg/L) 1/	Envirocorp's Detection Limit (mg/L)	ICF's Detection Limit (mg/L)	SW-846 Analytical Test Method
95	126-99-8	Chloroprene		-	7.0×10^{-1} c	5.0×10^{-3}	5.0×10^{-3}	8240
96	542-76-7	3-Chloropropionitrile		-	-	5.0×10^{-3}	5.0×10^{-3}	8240
97	7440-47-3	Chromium Chromium compounds, N.O.S. [1]		1.0×10^{-2}	1.0×10^{-1}	-	-	-
98	218-01-9	Chrysene		-	2.0×10^{-4}	1.0×10^{-2}	1.0×10^{-2}	8270
99	6358-53-8	Citrus red No. 2	p-Dimethylaminoazobenzene	-	-	1.0×10^{-2}	1.0×10^{-2}	8270
100	8007-45-2	Coal tar creosote		-	-	1.0×10^{-2}	1.0×10^{-2}	8250
101	544-92-3	Copper cyanide		2.0×10^{-1}	$2.0 \times 10^{+0}$ a	-	-	-
102	8021-39-4	Creosote		-	-	1.0×10^{-2}	1.0×10^{-2}	8250
103	1319-77-3	Cresol	Cresylic acid	$2.0 \times 10^{+0}$	$2.0 \times 10^{+0}$ a	-	-	-
104	4170-30-3	Crotonaldehyde		4.0×10^{-1}	2.0×10^{-5} b	-	-	-
105		Cyanides (soluble salts and complexes) N.O.S. [1]		7.0×10^{-1}	7.0×10^{-1} a	-	-	-
106	460-19-5	Cyanogen (Ethanedionitrile)	Ethanedionitrile	$1.0 \times 10^{+0}$	$1.0 \times 10^{+0}$ a	-	-	-
107	506-68-3	Cyanogen bromide	Acetonitrile	-	-	5.0×10^{-3}	1.0×10^{-1}	8240
108	506-77-4	Cyanogen chloride	Chlorine cyanide	$2.0 \times 10^{+0}$	-	-	1.0×10^{-1}	8240
109	14901-08-7	Cycasin	N-Nitrosodimethylamine *	-	-	1.0×10^{-2}	1.0×10^{-2}	8270
110	131-89-5	2-Cyclohexyl-4,6-dinitrophenol	4,6-Dinitro-o-cresol	-	-	1.0×10^{-2}	1.0×10^{-2}	8270
111	50-18-0	Cyclophosphamide	Hexamethyl Phosphoramine *	-	1.0×10^{-5} b	1.0×10^{-2}	2.0×10^{-2}	8270
112	94-75-7	2,4-D	2,4 Dichlorophenoxyacetic acid	1.0×10^{-1}	7.0×10^{-2}	-	-	-

ATTACHMENT 1 (Continued)

Evaluation of Envirocorp Inc.'s HBLs and Detection Limits (Based on Reference Molecule Approach)

No.	CAS No.	Chemical Name	Reference Molecule	Envirocorp's HBL (mg/L)	USEPA/CAD's HBL (mg/L) 1/	Envirocorp's Detection Limit (mg/L)	ICF's Detection Limit (mg/L)	SW-846 Analytical Test Method
113		2,4-D, salts, esters	2,4-D	-	-	1.0×10^{-2}	1.0×10^{-2}	8150
114	20830-81-3	Daunomycin	1,4-Naphthoquinone	-	-	1.0×10^{-2}	1.0×10^{-2}	8270
115	72-54-8	DDD		1.0×10^{-4}	1.0×10^{-4}	-	-	-
116	72-55-9	DDE		1.0×10^{-4}	1.0×10^{-4}	-	-	-
117	50-29-3	DDT		1.0×10^{-4}	1.0×10^{-4}	-	-	-
118	2303-16-4	Diallate		-	6.0×10^{-4}	1.0×10^{-2}	1.0×10^{-2}	8270
119	226-36-8	Dibenz[a,h]acridine	Dibenz[a,j]acridine	-	-	1.0×10^{-2}	1.0×10^{-2}	8270
120	224-42-0	Dibenz[a,j]acridine		-	-	1.0×10^{-2}	1.0×10^{-2}	8270
121	53-70-3	Dibenz[a,h]anthracene		7.0×10^{-7}	3.0×10^{-4}	-	-	-
122	194-59-2	7H-Dibenzo[c,g]carbazole	Diphenylamine	-	-	1.0×10^{-2}	1.0×10^{-2}	8270
123	132-64-9	Dibenzofuran		-	-	1.0×10^{-2}	1.0×10^{-2}	8270
124	192-65-4	Dibenzo[a,e]pyrene		-	-	1.0×10^{-2}	1.0×10^{-2}	8270
125	189-64-0	Dibenzo[a,h]pyrene	Dibenzo[a,e]pyrene	-	-	1.0×10^{-2}	1.0×10^{-2}	8270
126	189-55-9	Dibenzo[a,i]pyrene	Dibenzo[a,e]pyrene	-	-	1.0×10^{-2}	1.0×10^{-2}	8270
127	96-12-8	1,2-Dibromo-3-chloropropane		2.0×10^{-6}	2.0×10^{-4}	-	-	-
128	84-74-2	Dibutyl phthalate	Di-n-butyl phthalate	4.0×10^{-3}	$4.0 \times 10^{+0}$	-	-	-
129	95-50-1	o-Dichlorobenzene		6.0×10^{-1}	6.0×10^{-1}	-	-	-
130	541-73-1	m-Dichlorobenzene		6.0×10^{-1}	6.0×10^{-1} a	-	-	-
131	106-46-7	p-Dichlorobenzene		7.5×10^{-2}	7.5×10^{-2} c	-	-	-
132	25321-22-6	Dichlorobenzene, N.O.S. (1)	O-Dichlorobenzene	-	-	2.0×10^{-3}	2.0×10^{-3}	8010

ATTACHMENT 1 (Continued)

Evaluation of Envirocorp Inc.'s HBLs and Detection Limits (Based on Reference Molecule Approach)

No	CAS No	Chemical Name	Reference Molecule	Envirocorp's HBL (mg/L)	USEPA/CAD's HBL (mg/L) 1/	Envirocorp's Detection Limit (mg/L)	ICF's Detection Limit (mg/L)	SW-846 Analytical Test Method
133	91-94-1	3,3-Dichlorobenzidine		-	8.0×10^{-5}	1.0×10^{-2}	2.0×10^{-2}	8270
134	764-41-0	Trans-1,4-Dichloro-2-butene		-	-	5.0×10^{-3}	1.0×10^{-1}	8240
135	75-71-8	Dichlorodifluoromethane		$7.0 \times 10^{+0}$	$7.0 \times 10^{+0}$	-	-	-
136	25323-30-2	Dichloroethylene, N.O.S. [1]	1,2 Dichloroethylene	-	-	1.0×10^{-3}	1.0×10^{-3}	8010
137	75-35-4	1,1-Dichloroethylene	1,1-Dichloroethene	7.0×10^{-3}	7.0×10^{-3}	-	-	-
138	156-60-5	1,2-Dichloroethylene	1,2-Dichloroethene	-	1.0×10^{-1}	1.0×10^{-3}	1.0×10^{-3}	8010
139	111-44-4	Dichloroethyl ether [Bis(2-Chloroethyl) ether]		3.0×10^{-5}	3.0×10^{-5}	-	-	-
140	108-60-1	Dichloroisopropyl ether	Bis(2 chloro-1-methylethyl) ether	-	$1.0 \times 10^{+0}$	1.0×10^{-2}	1.0×10^{-2}	8270
141	111-91-1	Dichloromethoxyethane	Bis 2 Chloroethoxymethane	-	-	1.0×10^{-2}	1.0×10^{-2}	8270
142	542-88-1	Dichloromethyl ether	Bis chloromethyl ether	4.0×10^{-6}	-	-	1.0×10^{-2}	8270
143	120-83-2	2,4-Dichlorophenol		1.0×10^{-1}	1.0×10^{-1}	-	-	-
144	87-65-0	2,6-Dichlorophenol		-	-	1.0×10^{-2}	1.0×10^{-2}	8270
145	696-28-6	Dichlorophenylarsine	Arsenic	-	-	1.0×10^{-2}	1.0×10^{-2}	7060
146	26638-19-7	Dichloropropane, N.O.S. [1]	1,2-Dichloropropane	-	-	5.0×10^{-4}	5.0×10^{-4}	8010
147	26545-73-3	Dichloropropanol, N.O.S. [1]	1,2-Dichloropropane	-	-	5.0×10^{-4}	5.0×10^{-4}	8010
148	26952-23-8	Dichloropropene, N.O.S. [1]	1,3-Dichloropropene	-	-	5.0×10^{-3}	5.0×10^{-3}	8240
149	542-75-6	1,3-Dichloropropene		2.0×10^{-4}	2.0×10^{-4} c	-	-	-
150	60-57-1	Dieldrin		2.0×10^{-6}	2.0×10^{-6}	-	-	-
151	1464-53-5	1,2:3,4-Diepoxybutane		-	-	5.0×10^{-3}	5.0×10^{-3}	8240
152	692-42-2	Diethylarsine	Arsenic	-	-	1.0×10^{-2}	1.0×10^{-2}	7060

ATTACHMENT 1 (Continued)

Evaluation of Envirocorp Inc.'s HBLs and Detection Limits (Based on Reference Molecule Approach)

No.	CAS No.	Chemical Name	Reference Molecule	Envirocorp's HBL (mg/L)	USEPA/CAD's HBL (mg/L) 1/	Envirocorp's Detection Limit (mg/L)	ICF's Detection Limit (mg/L)	SW-846 Analytical Test Method
153	123-91-1	1,4-Diethyleneoxide	1,4 Dioxane	7.0×10^{-3}	3.0×10^{-3}	-	-	-
154	117-81-7	Diethylhexyl phthalate [Bis (2-ethyl hexyl) phthalate]		4.0×10^{-3}	4.0×10^{-3}	-	-	-
155	(7699-31-2) 1615-81-1	N,N'-Diethylhydrazine	1,2 Diphenyl hydrazine	-	-	1.0×10^{-2}	1.0×10^{-2}	8270
156	3288-58-2	O,O-Diethyl S-methyl dithiophosphate	Parathion	-	-	1.0×10^{-2}	1.0×10^{-2}	8270
157	311-45-5	Diethyl-p-nitrophenyl phosphate	Parathion	-	-	1.0×10^{-2}	1.0×10^{-2}	8270
158	84-66-2	Diethyl phthalate		$3.0 \times 10^{+1}$	$3.0 \times 10^{+1}$	-	-	-
159	297-97-2	O,O-Diethyl O-2-pyrazinyl phosphorothioate		-	-	1.0×10^{-2}	2.0×10^{-2}	8270
160	56-53-1	Diethylstilbesterol		7.0×10^{-9} c	7.0×10^{-9} c	-	-	-
161	94-58-6	Dihydrosafrole	Safrole	-	-	1.0×10^{-2}	1.0×10^{-2}	8270
162	55-91-4	Diisopropylfluorophosphate (DFP)	Phosphamidon *	-	-	1.0×10^{-2}	1.0×10^{-2}	8270
163	60-51-5	Dimethoate		7.0×10^{-1}	7.0×10^{-3}	-	-	
164	119-90-4	3,3'-Dimethoxybenzidine		-	3.0×10^{-3} c	1.0×10^{-1}	1.0×10^{-1}	8270
165	60-11-7	p-(Dimethylamino)azobenzene		-	-	1.0×10^{-2}	1.0×10^{-2}	8270
166	57-97-6	7,12-Dimethylbenz[a]anthracene		-	1.0×10^{-6} c	1.0×10^{-2}	1.0×10^{-2}	8270
167	119-93-7	3,3'-Dimethylbenzidine		-	4.0×10^{-6}	1.0×10^{-2}	1.0×10^{-2}	8270
168	79-44-7	Dimethylcarbamoyl chloride	Diallate	-	5.0×10^{-7} b	1.0×10^{-2}	1.0×10^{-2}	8270
169	57-14-7	1,1-Dimethylhydrazine	1,2 Diphenyl Hydrazine	-	1.0×10^{-5} b	1.0×10^{-2}	1.0×10^{-2}	8270
170	540-73-8	1,2-Dimethylhydrazine	1,2 Diphenyl Hydrazine	-	9.0×10^{-7} b	1.0×10^{-2}	1.0×10^{-2}	8270

ATTACHMENT 1 (Continued)

Evaluation of Envirocorp Inc.'s HBLs and Detection Limits (Based on Reference Molecule Approach)

No	CAS No	Chemical Name	Reference Molecule	Envirocorp's HBL (mg/L)	USEPA/CAD's HBL (mg/L) 1/	Envirocorp's Detection Limit (mg/L)	ICF's Detection Limit (mg/L)	SW-846 Analytical Test Method
171	122-09-8	alpha,alpha-Dimethylphenethylamine		-	-	1.0×10^{-2}	1.0×10^{-2}	8270
172	105-67-9	2,4-Dimethylphenol		-	7.0×10^{-1}	5.0×10^{-3}	5.0×10^{-3}	8040
173	131-11-3	Dimethyl phthalate		-	$4.0 \times 10^{+2}$	5.0×10^{-3}	5.0×10^{-3}	8060
174	77-78-1	Dimethyl sulfate	Diethyl sulfate	-	-	5.0×10^{-3}	5.0×10^{-3}	8250
175	25154-54-5	Dinitrobenzene, N.O.S. [1]	m-dinitrobenzene	-	-	1.0×10^{-2}	2.0×10^{-2}	8270
176	534-52-1	4,6-Dinitro-o-cresol		-	1.0×10^{-2}	5.0×10^{-2}	5.0×10^{-2}	8270
177		4,6-Dinitro-o-cresol salts	4,6 Dinitro-o-cresol	-	-	1.0×10^{-2}	1.0×10^{-2}	8270
178	51-28-5	2,4-Dinitrophenol		7.0×10^{-2}	7.0×10^{-2}	-	-	-
179	121-14-2	2,4-Dinitrotoluene		1.0×10^{-4}	5.0×10^{-5}	-	-	-
180	606-20-2	2,6-Dinitrotoluene		1.0×10^{-4}	5.0×10^{-5}	-	-	-
181	88-85-7	Dinoseb		4.0×10^{-2}	7.0×10^{-3}	-	-	-
182	117-84-0	Di-n-octyl-phthalate		-	7.0×10^{-1} c	1.0×10^{-2}	1.0×10^{-2}	8270
183	122-39-4	Diphenylamine		$1.0 \times 10^{+0}$	9.0×10^{-1}	-	-	-
184	122-66-7	1,2-Diphenylhydrazine		4.0×10^{-5}	4.0×10^{-5} c	-	-	-
185	621-64-7	Di-n-propylnitrosamine	N-Nitroso-di-N-propylamine	5.0×10^{-6}	-	-	1.0×10^{-2}	8270
186	298-04-4	Disulfoton		1.0×10^{-3}	1.0×10^{-3}	-	-	-
187	541-53-7	Dithiobiuret	Ethylene thiourea	-	-	1.0×10^{-2}	1.0×10^{-2}	8250
188	115-29-7	Endosulfan		2.0×10^{-3}	2.0×10^{-3} c	-	-	-
189	145-73-3	Endothall		7.0×10^{-1}	7.0×10^{-1} a	-	-	-
190	72-20-8	Endrin		2.0×10^{-4}	2.0×10^{-3}	-	-	-

ATTACHMENT 1 (Continued)

Evaluation of Envirocorp Inc.'s HBLs and Detection Limits (Based on Reference Molecule Approach)

No.	CAS No.	Chemical Name	Reference Molecule	Envirocorp's HBL (mg/L)	USEPA/CAD's HBL (mg/L) 1/	Envirocorp's Detection Limit (mg/L)	ICF's Detection Limit (mg/L)	SW-846 Analytical Test Method
191		Endrin metabolites	Endrin	-	-	1.0×10^{-4}	1.0×10^{-4}	8080
192	106-89-8	Epichlorohydrin	1-chloro-2,3-epoxy propane	4.0×10^{-3}	4.0×10^{-3} a	-	-	-
193	51-43-4	Epinephrine	o-cresol	-	-	1.0×10^{-2}	1.0×10^{-2}	8270
194	51-79-6	Ethyl carbamate	Urethane	-	-	5.0×10^{-2}	5.0×10^{-2}	8270
195	107-12-0	Ethyl cyanide	Propionitrile	-	-	5.0×10^{-3}	1.0×10^{-1}	8240
196	100-41-4	Ethyl benzene		7.0×10^{-1}	7.0×10^{-1}	-	-	-
197	111-54-6	Ethylenebisdithiocarbamic acid	Ethyl Carbamate *	-	-	1.0×10^{-2}	1.0×10^{-2}	8270
198		Ethylenebisdithiocarbamic acid, salts and esters	Ethyl Carbamate *	-	-	1.0×10^{-2}	5.0×10^{-2}	8270
199	106-93-4	Ethylene dibromide		5.0×10^{-5}	5.0×10^{-5}	-	-	-
200	107-06-2	Ethylene dichloride	1,2-Dichloroethane	5.0×10^{-3}	5.0×10^{-3}	-	-	-
201	110-80-5	Ethylene glycol monoethyl ether	2-Ethoxyethanol	-	-	5.0×10^{-3}	NA	8240
202	151-56-4	Ethyleneimine	N-Propylamine	-	-	5.0×10^{-3}	5.0×10^{-3}	8240
203	75-21-8	Ethylene oxide	Oxirane	1.0×10^{-4}	3.0×10^{-5} b	-	-	-
204	96-45-7	Ethylenethiourea		-	6.0×10^{-5} b	1.0×10^{-2}	1.0×10^{-2}	8250
205	75-34-3	Ethylene dichloride	1,1 Dichloroethane	-	4.0×10^{-4}	1.0×10^{-3}	1.0×10^{-3}	8010
206	97-63-2	Ethyl methacrylate		-	$3.0 \times 10^{+0}$	5.0×10^{-3}	5.0×10^{-3}	8240
207	62-50-0	Ethyl methanesulfonate		-	1.0×10^{-6} c	1.0×10^{-2}	2.0×10^{-2}	8270
208	52-85-7	Famphur		-	1.0×10^{-3} c	1.0×10^{-2}	2.0×10^{-2}	8270

ATTACHMENT 1 (Continued)

Evaluation of Envirocorp Inc.'s HBLs and Detection Limits (Based on Reference Molecule Approach)

No	CAS No	Chemical Name	Reference Molecule	Envirocorp's HBL (mg/L)	USEPA/CAD's HBL (mg/L) 1/	Envirocorp's Detection Limit (mg/L)	ICF's Detection Limit (mg/L)	SW-846 Analytical Test Method
209	206-44-0	Fluoranthene		-	$1.0 \times 10^{+0}$	1.0×10^{-2}	1.0×10^{-2}	8270
210	86-73-7	Fluorene		-	$1.0 \times 10^{+0}$	1.0×10^{-2}	1.0×10^{-2}	8270
211		Fluoride		$4.0 \times 10^{+0}$	$4.0 \times 10^{+0}$	-	-	-
212	7782-41-4	Fluorine		$4.0 \times 10^{+0}$	$4.0 \times 10^{+0}$ a	-	-	-
213	640-19-7	Fluoroacetamide	Acrylamide *	-	-	5.0×10^{-3}	1.0×10^{-2}	8240
214	62-74-8	Fluoroacetic acid, sodium salt	Benzoic Acid *	-	-	5.0×10^{-3}	1.0×10^{-2}	8250
215	50-00-0	Formaldehyde		-	$7.0 \times 10^{+0}$ b	5.0×10^{-3}	NA	8240
216	64-18-6	Formic acid		-	$7.0 \times 10^{+1}$ c	1.0×10^{-2}	1.0×10^{-2}	8250
217	765-34-4	Glycidylaldehyde	2-Ethoxy ethanol	-	1.0×10^{-2} b	5.0×10^{-3}	NA	8240
218		Halomethanes, N.O.S. [1]	Chloroform	-	-	5.0×10^{-4}	5.0×10^{-4}	8010
219	76-44-8	Heptachlor		8.0×10^{-6}	4.0×10^{-4}	-	-	-
220	1024-57-3	Heptachlor epoxide		4.0×10^{-6}	2.0×10^{-4}	-	-	-
221		Heptachlor epoxide (alpha, beta and gamma isomers)	Heptachlor	-	-	5.0×10^{-5}	5.0×10^{-5}	8080
222		Heptachlorodibenzofurans	Poly chlorinated Dibenzofuran	-	-	1.0×10^{-5}	1.0×10^{-5}	8280
223		Heptachlorodibenzo-p-dioxins	Poly chlorinated p-dioxins	-	6.0×10^{-9} a	1.0×10^{-5}	1.0×10^{-5}	8280
224	118-74-1	Hexachlorobenzene		2.0×10^{-5}	1.0×10^{-3}	-	-	-
225	87-68-3	Hexachlorobutadiene		5.0×10^{-3}	4.0×10^{-4}	-	-	-
226	77-47-4	Hexachlorocyclopentadiene		2.0×10^{-1}	5.0×10^{-2}	-	-	-
227		Hexachlorodibenzo-p-dioxins		6.0×10^{-9}	5.0×10^{-7} b	-	-	-
228		Hexachlorodibenzofurans	Polychlorinated dibenzofurans	-	5.0×10^{-7} b	1.0×10^{-5}	1.0×10^{-5}	8280

ATTACHMENT 1 (Continued)

Evaluation of Envirocorp Inc.'s HBLs and Detection Limits (Based on Reference Molecule Approach)

No.	CAS No.	Chemical Name	Reference Molecule	Envirocorp's HBL (mg/L)	USEPA/CAD's HBL (mg/L) 1/	Envirocorp's Detection Limit (mg/L)	ICF's Detection Limit (mg/L)	SW-846 Analytical Test Method
229	67-72-1	Hexachloroethane		3.0×10^{-2}	3.0×10^{-3}	-	-	-
230	70-30-4	Hexachlorophene		-	1.0×10^{-2}	-	-	-
231	1888-71-7	Hexachloropropene		-	-	1.0×10^{-2}	1.0×10^{-2}	8270
232	757-58-4	Hexaethyl tetraphosphate	Tributyl phosphate *	-	-	1.0×10^{-2}	1.0×10^{-2}	8270
233	591-78-6	2-Hexanone		-	-	5.0×10^{-2}	5.0×10^{-2}	8240
234	302-01-2	Hydrazine		1.0×10^{-5}	1.0×10^{-5} b	-	-	-
235		Hydrazine sulfate		1.0×10^{-5}	1.0×10^{-5} a	-	-	-
236	74-90-8	Hydrogen cyanide		7.0×10^{-1}	7.0×10^{-1} a	-	-	-
237	7664-39-3	Hydrogen fluoride	Fluoride	$4.0 \times 10^{+0}$	$4.0 \times 10^{+0}$ d	-	-	-
238	7783-06-4	Hydrogen sulfide		1.0×10^{-1}	1.0×10^{-1} b	-	-	-
239	193-39-5	Indeno[1,2,3-cd] pyrene		-	4.0×10^{-4}	-	-	-
240	78-83-1	Isobutyl alcohol		$1.0 \times 10^{+1}$	$1.0 \times 10^{+1}$	-	-	-
241	465-73-6	Isodrin		-	-	1.0×10^{-2}	1.0×10^{-2}	8270
242	78-59-1	Isophorone		$7.0 \times 10^{+1}$	9.0×10^{-3}	-	-	-
243	120-58-1	Isosafrole		-	-	1.0×10^{-2}	1.0×10^{-2}	8270
244	143-50-0	Kepone		-	2.0×10^{-6} c	1.0×10^{-2}	-	-
245	303-34-4	Lasiocarpine	N-Nitrosopyrrolidine *	-	6.0×10^{-6} b	1.0×10^{-2}	1.0×10^{-2}	8270
246	7439-92-1	Lead		5.0×10^{-2}	1.5×10^{-2} c	-	-	-
247		Lead compounds, N.O.S. [1]		5.0×10^{-2}	1.5×10^{-2} d	-	-	-
248	301-04-2	Lead acetate	Lead	-	-	1.0×10^{-2}	1.0×10^{-2}	7421

ATTACHMENT 1 (Continued)

Evaluation of Envirocorp Inc.'s HBLs and Detection Limits (Based on Reference Molecule Approach)

No	CAS No	Chemical Name	Reference Molecule	Envirocorp's HBL (mg/L)	USEPA/CAD's HBL (mg/L) 1/	Envirocorp's Detection Limit (mg/L)	ICF's Detection Limit (mg/L)	SW-846 Analytical Test Method
249	7446-27-7	Lead phosphate	Lead	-	-	1.0×10^{-2}	1.0×10^{-2}	7421
250	1335-32-6	Lead subacetate	Lead	-	-	1.0×10^{-2}	1.0×10^{-2}	7421
251	58-89-9	Lindane		4.0×10^{-3}	2.0×10^{-4} c	-	-	-
252	108-31-6	Maleic anhydride		-	$4.0 \times 10^{+0}$ b	1.0×10^{-2}	1.0×10^{-2}	8250
253	123-33-1	Maleic hydrazide		$2.0 \times 10^{+1}$	$2.0 \times 10^{+1}$ b	-	-	-
254	109-77-3	Malononitrile		-	7.0×10^{-4} b	5.0×10^{-3}	5.0×10^{-3}	8240
255	148-82-3	Melphalan	alpha, alpha Dimethylphenethylamine	-	-	1.0×10^{-2}	1.0×10^{-2}	8270
256	7439-97-6	Mercury		2.0×10^{-3}	2.0×10^{-3}	-	-	-
257		Mercury compounds, N.O.S. [1]		2.0×10^{-3}	2.0×10^{-3} d	-	-	-
258	628-86-4	Mercury fulminate	Mercury	-	-	2.0×10^{-3}	2.0×10^{-3}	7470
259	126-98-7	Methacrylonitrile		4.0×10^{-3}	4.0×10^{-3}	-	-	-
260	91-80-5	Methapyrilene		-	-	1.0×10^{-2}	1.0×10^{-2}	8270
261	16752-77-5	Methomyl		$1.0 \times 10^{+0}$	9.0×10^{-1} b	-	-	-
262	72-43-5	Methoxychlor		1.0×10^{-1}	4.0×10^{-2}	-	-	-
263	74-83-9	Methyl bromide		1.0×10^{-2}	5.0×10^{-2}	-	-	-
264	74-87-3	Methyl chloride		5.0×10^{-3}	3.0×10^{-3} c	-	-	-
265	79-22-1	Methylchlorocarbonate	Chloractaldehyde	-	-	5.0×10^{-3}	5.0×10^{-3}	8240
266	71-55-6	Methyl chloroform		2.0×10^{-1}	2.0×10^{-1}	-	-	-
267	56-49-5	3-Methylcholanthrene		4.0×10^{-6}	1.0×10^{-6}	-	-	-
268	101-14-4	4,4'-Methylenebis(2-chloroaniline)		2.0×10^{-4}	3.0×10^{-4} b	-	-	-

ATTACHMENT 1 (Continued)

Evaluation of Envirocorp Inc.'s HBLs and Detection Limits (Based on Reference Molecule Approach)

No.	CAS No.	Chemical Name	Reference Molecule	Envirocorp's HBL (mg/L)	USEPA/CAD's HBL (mg/L) 1/	Envirocorp's Detection Limit (mg/L)	ICF's Detection Limit (mg/L)	SW-846 Analytical Test Method
269	74-95-3	Methylene bromide		-	-	1.0×10^{-2}	1.0×10^{-2}	8240
270	75-09-2	Methylene chloride		5.0×10^{-3}	5.0×10^{-3}	-	-	-
271	78-93-3	Methyl ethyl ketone (MEK)		$2.0 \times 10^{+0}$	$2.0 \times 10^{+0}$ c	-	-	-
272	1338-23-4	Methyl ethyl ketone peroxide	MEK	-	-	1.0×10^{-2}	1.0×10^{-2}	8240
273	60-34-4	Methyl hydrazine	1,2-Diphenylhydrazine	-	3.0×10^{-5} b	1.0×10^{-2}	1.0×10^{-2}	8270
274	74-88-4	Methyl iodide		-	-	5.0×10^{-3}	5.0×10^{-3}	8240
275	108-10-1	Methyl isobutyl ketone		$2.0 \times 10^{+0}$	$2.0 \times 10^{+0}$ c	-	-	-
276	624-83-9	Methyl isocyanate	Toluene diisocyanate	-	-	1.0×10^{-2}	1.0×10^{-2}	8250
277	75-86-5	2-Methylacrylonitrile	Propionitrile	-	-	5.0×10^{-3}	5.0×10^{-3}	8240
278	80-62-6	Methyl methacrylate		-	$3.0 \times 10^{+0}$	2.0×10^{-3}	$3.0 \times 10^{+0}$	8015
279	66-27-3	Methyl methanesulfonate		-	-	1.0×10^{-2}	1.0×10^{-2}	8270
280	298-00-0	Methyl parathion		1.0×10^{-2}	9.0×10^{-3}	-	-	-
281	56-04-2	Methylthiouracil	Propylthiouracil	-	-	1.0×10^{-2}	1.0×10^{-2}	8270
282	50-07-7	Mitomycin C	1,4-Napthquinone	-	-	1.0×10^{-2}	1.0×10^{-2}	8270
283	70-25-7	MNNG	N-Nitrosodimethyl amine	-	-	1.0×10^{-2}	1.0×10^{-2}	8270
284	505-60-2	Mustard gas	Ethylene thiourea	-	-	1.0×10^{-2}	1.0×10^{-2}	8270
285	91-20-3	Naphthalene		-	$1.0 \times 10^{+0}$	1.0×10^{-2}	$1.0 \times 10^{+0}$	8270
286	130-15-4	1,4-Naphthoquinone		-	-	1.0×10^{-2}	1.0×10^{-2}	8270
287	134-32-7	alpha-Naphthylamine (Alpha = 1)		-	-	1.0×10^{-2}	1.0×10^{-2}	8270
288	91-59-8	beta-Naphthylamine (Beta=2)		-	4.0×10^{-5} c	1.0×10^{-2}	1.0×10^{-2}	8270

ATTACHMENT 1 (Continued)

Evaluation of Envirocorp Inc.'s HBLs and Detection Limits (Based on Reference Molecule Approach)

No.	CAS No	Chemical Name	Reference Molecule	Envirocorp's HBL (mg/L)	USEPA/CAD's HBL (mg/L) 1/	Envirocorp's Detection Limit (mg/L)	ICF's Detection Limit (mg/L)	SW-846 Analytical Test Method
289	86-86-4	alpha-Naphthylthiourea	Ethylene thiourea	-	-	1.0×10^{-2}	1.0×10^{-2}	8250
290	7440-02-0	Nickel		7.0×10^{-1}	1.0×10^{-1}	-	-	-
291		Nickel compounds, N.O.S. [1]		7.0×10^{-1}	1.0×10^{-1} d	-	-	-
292	13463-39-3	Nickel carbonyl	Nickel	-	-	5.0×10^{-3}	5.0×10^{-3}	6010
293	557-19-7	Nickel cyanide	Nickel	-	-	5.0×10^{-3}	5.0×10^{-3}	6010
294	54-11-5	Nicotine		-	-	2.0×10^{-2}	1.0×10^{-2}	8270
295		Nicotine salts	Nicotine	-	-	1.0×10^{-2}	1.0×10^{-2}	8270
296	10102-43-9	Nitric oxide		$4.0 \times 10^{+0}$	$4.0 \times 10^{+0}$ b	-	-	-
297	88-74-4	o-Nitroaniline		-	-	5.0×10^{-2}	5.0×10^{-2}	8270
298	99-09-2	m-Nitroaniline		-	-	5.0×10^{-2}	5.0×10^{-2}	8270
299	100-01-6	p-Nitroaniline		-	-	5.0×10^{-2}	5.0×10^{-2}	8270
300	98-95-3	Nitrobenzene		2.0×10^{-2}	2.0×10^{-2}	-	-	-
301	10102-44-0	Nitrogen dioxide		$4.0 \times 10^{+1}$	$4.0 \times 10^{+1}$ b	-	-	-
302	51-75-2	Nitrogen mustard	Diphenylamine *	-	-	1.0×10^{-2}	5.0×10^{-2}	8270
303		Nitrogen mustard hydrochloride salt	Diphenylamine *	-	-	1.0×10^{-2}	5.0×10^{-2}	8270
304	126-85-2	Nitrogen mustard N-oxide	Diphenylamine *	-	-	1.0×10^{-2}	5.0×10^{-2}	8270
305		Nitrogen mustard N-oxide hydrochloride salt	Diphenylamine *	-	-	1.0×10^{-2}	5.0×10^{-2}	8270
306	55-63-0	Nitroglycerin	2-Nitropropane	-	-	5.0×10^{-3}	5.0×10^{-3}	8240
307	88-75-5	o-Nitrophenol		-	-	5.0×10^{-3}	5.0×10^{-3}	8040
308	100-02-7	p-Nitrophenol		-	-	1.0×10^{-2}	5.0×10^{-3}	8040

ATTACHMENT 1 (Continued)

Evaluation of Envirocorp Inc.'s HBLs and Detection Limits (Based on Reference Molecule Approach)

No.	CAS No.	Chemical Name	Reference Molecule	Envirocorp's HBL (mg/L)	USEPA/CAD's HBL (mg/L) 1/	Envirocorp's Detection Limit (mg/L)	ICF's Detection Limit (mg/L)	SW-846 Analytical Test Method
309	79-46-9	2-Nitropropane		4.0×10^{-6}	4.0×10^{-6} c	-	-	-
310	35576-91-1D	Nitrosamines, N.O.S. [1]	N-Nitrosodimethylamine	-	-	1.0×10^{-4}	1.0×10^{-2}	8270
311	924-16-3	N-Nitrosodi-n-butylamine (Dibutylnitrosamine)	Dibutylnitrosamine	6.0×10^{-6}	6.0×10^{-6}	-	-	-
312	1116-54-7	N-Nitrosodiethanolamine		1.0×10^{-5}	1.0×10^{-5} b	-	-	-
313	55-18-5	N-Nitrosodiethylamine (diethyl nitrosamine)	Diethylnitrosamine	2.0×10^{-7}	2.0×10^{-7}	-	-	-
314	62-75-9	N-Nitrosodimethylamine		7.0×10^{-7}	7.0×10^{-7}	-	-	-
315	759-73-9	N-Nitroso-N-ethylurea	N-Nitrosodiethylamine	-	2.0×10^{-6} b	1.0×10^{-2}	1.0×10^{-2}	8270
316	10595-95-6	N-Nitrosomethylethylamine		2.0×10^{-6}	2.0×10^{-6}	-	-	-
317	684-93-5	N-Nitroso-N-methylurea		1.0×10^{-7}	1.0×10^{-7} b	-	-	-
318	615-53-2	N-Nitroso-N-methylurethane	N-Nitrosodimethylamine	-	-	1.0×10^{-4}	1.0×10^{-2}	8270
319	4549-40-0	N-Nitrosomethylvinylamine	N-Nitrosodimethylamine	-	-	1.0×10^{-4}	1.0×10^{-2}	8270
320	59-89-2	N-Nitrosomorpholine		-	-	1.0×10^{-4}	1.0×10^{-2}	8270
321	16543-55-8	N-Nitrosonornicotine	Nicotine *	-	-	1.0×10^{-4}	1.0×10^{-2}	8270
322	100-75-4	N-Nitrosopiperidine		-	8.0×10^{-6} c	1.0×10^{-4}	9.0×10^{-7}	8270
323	930-55-2	N-Nitrosopyrrolidine		2.0×10^{-5}	2.0×10^{-5}	-	-	-
324	13256-22-9	N-Nitrososarcosine	N-Nitrosodimethylamine	-	-	1.0×10^{-4}	1.0×10^{-2}	8270
325	99-55-8	5-Nitro-o-toluidine		-	-	1.0×10^{-2}	1.0×10^{-2}	8270
326	152-16-9	Octamethylpyrophosphoramide		7.0×10^{-2}	7.0×10^{-2} c	-	-	-
327	20816-12-0	Osmium tetroxide	Osmium	-	-	3.0×10^{-1}	3.0×10^{-1}	7550
328	123-63-7	Paraldehyde		-	-	5.0×10^{-3}	5.0×10^{-3}	8240

ATTACHMENT 1 (Continued)

Evaluation of Envirocorp Inc.'s HBLs and Detection Limits (Based on Reference Molecule Approach)

No	CAS No	Chemical Name	Reference Molecule	Envirocorp's HBL (mg/L)	USEPA/CAD's HBL (mg/L) 1/	Envirocorp's Detection Limit (mg/L)	ICF's Detection Limit (mg/L)	SW-846 Analytical Test Method
329	56-38-2	Parathion		1.0×10^{-2}	2.0×10^{1}	-	-	-
330	608-93-5	Pentachlorobenzene		3.0×10^{-2}	3.0×10^{-2}	-	-	-
331		Pentachlorodibenzo-p-dioxins	Polychlorinated dibenzo-p-dioxin	-	-	1.0×10^{-5}	1.0×10^{-5}	8280
332		Pentachlorobenzofurans	Polychlorinated dibenzofuran	-	-	1.0×10^{-5}	1.0×10^{-5}	8280
333	76-01-7	Pentachloroethane		-	-	5.0×10^{-3}	5.0×10^{-3}	8240
334	82-68-8	Pentachloronitrobenzene (PCNB)	PCNB	1.0×10^{-3}	1.0×10^{-4}	-	-	-
335	87-86-5	Pentachlorophenol		2.0×10^{-2}	1.0×10^{-3}	-	-	-
336	62-44-2	Phenacetin		-	-	1.0×10^{-2}	1.0×10^{-2}	8270
337	108-95-2	Phenol		$1.0 \times 10^{+0}$	$2.0 \times 10^{+1}$	-	$1.0 \times 10^{+0}$	-
338	85-01-8	Phenanthrene		-	-	1.0×10^{-2}	1.0×10^{-2}	8270
339	106-50-3	Phenylenediamine acetate		3.0×10^{-3}	3.0×10^{-3} a	-	-	-
340	62-38-4	Phenylmercury acetate	Mercury	3.0×10^{-3}	_	-	2.0×10^{-3}	7470
341	103-85-5	Phenylthiourea	Ethylene thiourea	-	_	1.0×10^{-2}	1.0×10^{-2}	8250
342	75-44-5	Phosgene	Methylene chloride	-	_	1.0×10^{-4}	5.0×10^{-3}	8010
343	7803-51-2	Phosphine		1.0×10^{-2}	1.0×10^{-2} b	-	-	-
344	298-02-2	Phorate		-	7.0×10^{-3}	2.0×10^{-3}	2.0×10^{-3}	8140
345		Phthalic acid ester N.O.S. [1]	Phthalic anhydride	-	-	1.0×10^{-2}	1.0×10^{-2}	8250
345	85-44-9	Phthalic anhydride		-	$7.0 \times 10^{+1}$ b	1.0×10^{-2}	1.0×10^{-2}	8250
347	109-06-8	2-Picoline		-	-	5.0×10^{-3}	5.0×10^{-3}	8240
348		Polychlorinated biphenyls N.O.S. [1] (PCB's)	PCB's	5.0×10^{-5}	5.0×10^{-4} a	-	-	-

ATTACHMENT 1 (Continued)

Evaluation of Envirocorp Inc.'s HBLs and Detection Limits (Based on Reference Molecule Approach)

No.	CAS No.	Chemical Name	Reference Molecule	Envirocorp's HBL (mg/L)	USEPA/CAD's HBL (mg/L) 1/	Envirocorp's Detection Limit (mg/L)	ICF's Detection Limit (mg/L)	SW-846 Analytical Test Method
349	151-50-8	Potassium cyanide		$2.0 \times 10^{+0}$	$2.0 \times 10^{+0}$ a	-	-	-
350	506-61-6	Potassium silver cyanide		$7.0 \times 10^{+0}$	$7.0 \times 10^{+0}$ a	-	-	-
351	23950-58-5	Pronamide	Kerb	$3.0 \times 10^{+0}$	$3.0 \times 10^{+0}$	-	-	-
352	1120-71-4	1,3-Propane sultone	Ethylene thiourea	-	9.0×10^{-6} b	1.0×10^{-2}	1.0×10^{-2}	8250
353	107-10-8	n-Propylamine		-	-	5.0×10^{-3}	5.0×10^{-3}	8240
354	107-19-7	Propargyl alcohol		-	-	5.0×10^{-3}	5.0×10^{-3}	8240
355	78-87-5	Propylene dichloride	1,2-Dichloropropane	-	5.0×10^{-3}	3.0×10^{-4}	5.0×10^{-4}	8010
356	75-55-8	1,2-Propylenimine	n-Propylamine	-	-	5.0×10^{-3}	5.0×10^{-3}	8240
357	51-52-2	Propylthiouracil		-	-	1.0×10^{-1}	1.0×10^{-2}	8270
358	129-00-0	Pyrene		-	$1.0 \times 10^{+0}$	1.0×10^{-2}	1.0×10^{-2}	8270
359	110-86-1	Pyridine		4.0×10^{-2}	4.0×10^{-2}	-	-	-
360	50-55-5	Reserpine		3.0×10^{-6}	3.0×10^{-6} b	-	-	-
361	108-46-3	Resorcinol		-	-	1.0×10^{-1}	1.0×10^{-3}	8270
362	81-07-2	Saccharin	Ethylene thiourea *	-	-	1.0×10^{-2}	1.0×10^{-2}	8250
363		Saccharin salts	Ethylene thiourea *	-	-	1.0×10^{-2}	1.0×10^{-2}	8250
364	94-59-7	Safrole		-	1.0×10^{-4} c	1.0×10^{-2}	1.0×10^{-2}	8270
365	7782-49-2	Selenium		1.0×10^{-2}	5.0×10^{-2}	-	-	-
366		Selenium compounds, N.O.S. [1]		1.0×10^{-2}	5.0×10^{-2} d	-	-	-
367	7783-00-8	Selenium dioxide	Selenium	-	1.0×10^{-1} b	2.0×10^{-2}	2.0×10^{-2}	7741
368	7488-56-4	Selenium sulfide	Selenium	-	-	2.0×10^{-2}	2.0×10^{-2}	7741

ATTACHMENT 1 (Continued)

Evaluation of Envirocorp Inc.'s HBLs and Detection Limits (Based on Reference Molecule Approach)

No	CAS No	Chemical Name	Reference Molecule	Envirocorp's HBL (mg/L)	USEPA/CAD's HBL (mg/L) 1/	Envirocorp's Detection Limit (mg/L)	ICF's Detection Limit (mg/L)	SW-846 Analytical Test Method
369	630-10-4	Selenourea		2.0×10^{-1}	2.0×10^{-1} b	-	2.0×10^{-1}	-
370	7440-22-4	Silver		5.0×10^{-2}	2.0×10^{-1}	-	-	-
371		Silver and compounds, N.O.S. [1]		5.0×10^{-2}	2.0×10^{-1} d	-	-	-
372	506-64-9	Silver cyanide		$4.0 \times 10^{+0}$	$4.0 \times 10^{+0}$ a	-	-	-
373	93-72-1	Silvex (2,4,5-TP)		3.0×10^{-1}	5.0×10^{-2}	-	-	-
374	143-33-9	Sodium cyanide		$1.0 \times 10^{+0}$	$1.0 \times 10^{+0}$ a	-	-	-
375	18883-66-4	Streptozotocin	N-Nitrosodimethylamine	-	2.0×10^{-6} b	1.0×10^{-4}	1.0×10^{-2}	8270
376	57-24-9	Strychnine		1.0×10^{-2}	1.0×10^{-2} c	-	-	-
377		Strychnine salts		1.0×10^{-2}	1.0×10^{-2} a	-	-	-
378	100-42-5	Styrene		1.0×10^{-3}	1.0×10^{-1}	-	-	-
379	1746-01-6	TCDD		-	3.0×10^{-8}	5.0×10^{-6}	5.0×10^{-6}	8280
380	95-94-3	1,2,4,5-Tetrachlorobenzene		1.0×10^{-2}	1.0×10^{-2}	-	-	-
381	51207-31-9	Tetrachlorodibenzofurans	Polychlorinated dibenzofuran	-	-	1.0×10^{-5}	1.0×10^{-5}	8280
382	25322-20-7	Tetrachloroethane, N.O.S. [1]		-	-	5.0×10^{-4}	5.0×10^{-4}	8010
383	630-20-6	1,1,1,2-Tetrachloroethane		-	1.0×10^{-3}	5.0×10^{-3}	5.0×10^{-3}	8240
384	79-34-5	1,1,2,2-Tetrachloroethane		2.0×10^{-3}	2.0×10^{-4}	-	-	-
385	127-18-4	Tetrachloroethylene		5.0×10^{-3}	5.0×10^{-3}	-	-	-
386	58-90-2	2,3,4,6-Tetrachlorophenol		$1.0 \times 10^{+0}$	$1.0 \times 10^{+0}$	-	-	-
387	3689-24-5	Tetraethyl dithiopyrophosphate		-	2.0×10^{-2}	1.0×10^{-2}	1.0×10^{-2}	8270
388	78-00-2	Tetraethyl lead		4.0×10^{-6}	4.0×10^{-6} b	-	-	-

ATTACHMENT 1 (Continued)

Evaluation of Envirocorp Inc.'s HBLs and Detection Limits (Based on Reference Molecule Approach)

No.	CAS No.	Chemical Name	Reference Molecule	Envirocorp's HBL (mg/L)	USEPA/CAD's HBL (mg/L) 1/	*Envirocorp's* Detection Limit (mg/L)	ICF's *Detection* Limit (mg/L)	SW-846 Analytical Test Method
389	107-49-3	Tetraethyl pyrophosphate	Tributyl phosphate *	-	-	4.0×10^{-2}	1.0×10^{-2}	8270
390	509-14-8	Tetranitromethane	2-Nitropropane	-	-	5.0×10^{-3}	5.0×10^{-3}	8240
391	7440-28-0	Thallium		-	2.0×10^{-3}	1.0×10^{-2}	1.0×10^{-3}	7841
392		*Thallium compounds, N.O.S. [1]*		-	2.0×10^{-3} d	1.0×10^{-2}	1.0×10^{-2}	7841
393	1314-32-5	Thallic oxide		1.0×10^{-2}	1.0×10^{-2} a	-	-	-
394	563-68-8	Thallium (1) acetate		2.0×10^{-2}	2.0×10^{-2} a	-	-	-
395	6533-73-9	Thallium (1) carbonate		1.0×10^{-2}	1.0×10^{-2} a	-	-	-
396	7791-12-0	Thallium (1) chloride		1.0×10^{-2}	1.0×10^{-2} a	-	-	-
397	10102-45-1	Thallium (1) nitrate		2.0×10^{-2}	2.0×10^{-2} a	-	-	-
398	12039-52-0	Thallium selenite		2.0×10^{-2}	2.0×10^{-2} a	-	-	-
399	7446-18-6	Thallium (1) sulfate		1.0×10^{-2}	1.0×10^{-2} a	-	-	-
400	62-55-5	Thioacetamide	Ethylene thiourea	-	7.0×10^{-6} b	1.0×10^{-2}	1.0×10^{-2}	8250
401	39196-18-4	Thiofanox	Ethylene thiourea	-	1.0×10^{-2} b	1.0×10^{-2}	1.0×10^{-2}	8250
402	74-93-1	Thiomethanol	Ethylene thiourea	-	-	1.0×10^{-2}	1.0×10^{-2}	8250
403	108-98-5	Thiophenol		-	-	2.0×10^{-2}	1.0×10^{-2}	8270
404	79-19-6	Thiosemicarbazide	Ethylene thiourea *	-	-	1.0×10^{-2}	1.0×10^{-2}	8250
405	62-56-6	Thiourea		5.0×10^{-5}	2.0×10^{-5} b	-	-	-
406	137-26-8	Thiram		2.0×10^{-1}	2.0×10^{-1} b	-	-	-
407	108-88-3	Toluene		$2.0 \times 10^{+0}$	$1.0 \times 10^{+0}$	-	-	-
408	25376-45-8	Toluenediamine		-	-	1.0×10^{-2}	1.0×10^{-2}	8250

ATTACHMENT 1 (Continued)

Evaluation of Envirocorp Inc.'s HBLs and Detection Limits (Based on Reference Molecule Approach)

No	CAS No	Chemical Name	Reference Molecule	Envirocorp's HBL (mg/L)	USEPA/CAD's HBL (mg/L) 1/	Envirocorp's Detection Limit (mg/L)	ICF's Detection Limit (mg/L)	SW-846 Analytical Test Method
409	95-80-7	Toluene-2,4-diamine		-	1.0×10^{-4} c	1.0×10^{-2}	1.0×10^{-2}	8250
410	823-40-5	Toluene-2,6-diamine		-	2.0×10^{-4} c	1.0×10^{-2}	1.0×10^{-2}	8250
411	496-72-0	Toluene-3,4-diamine		-	-	1.0×10^{-2}	1.0×10^{-2}	8250
412	26471-62-5	Toluene diisocyanate		-	-	1.0×10^{-2}	1.0×10^{-2}	8250
413	95-53-4	o-Toluidine		-	1.0×10^{-4}	1.0×10^{-2}	1.0×10^{-2}	8270
414	636-21-5	o-Toluidine hydrochloride	o-Toluidine	-	-	1.0×10^{-2}	1.0×10^{-2}	8270
415	106-49-0	p-Toluidine	o-Toluidine	-	2.0×10^{-4} c	1.0×10^{-2}	1.0×10^{-2}	8270
416	8001-35-2	Toxaphene		5.0×10^{-3}	3.0×10^{-3}	-	-	-
417	120-82-1	1,2,4-Trichlorobenzene		7.0×10^{-1}	7.0×10^{-2}	-	-	-
418	79-00-5	1,1,2-Trichloroethane		6.0×10^{-3}	5.0×10^{-3}	-	-	-
419	79-01-6	Trichloroethylene	1,1,2-Trichloroethene	5.0×10^{-3}	5.0×10^{-3}	-	-	-
420	75-70-7	Trichloromethanethiol	Ethylene thiourea *	-	-	5.0×10^{-4}	1.0×10^{-2}	8250
421	75-69-4	Trichloromonofluoromethane		$1.0 \times 10^{+1}$	$1.0 \times 10^{+1}$	-	-	-
422	79-00-5	1,1,2 Trichloropropane 4/	1,2,3-Trichloropropane	2.0×10^{-1}	-	-	5.0×10^{-3}	8240
423	95-95-4	2,4,5-Trichlorophenol		$4.0 \times 10^{+0}$	$4.0 \times 10^{+0}$	-	-	-
424	88-06-2	2,4,6-Trichlorophenol		2.0×10^{-3}	3.0×10^{-3}	-	-	-
425	93-76-5	2,4,5-T		1.0×10^{-2}	4.0×10^{-1}	-	-	-
426	25735-29-9	Trichloropropane, N.O.S. (1)	1,2,3-Trichloropropane	-	-	5.0×10^{-3}	5.0×10^{-3}	8240
427	96-18-4	1,2,3-Trichloropropane		4.0×10^{-2}	2.0×10^{-1}	-	-	-
428	126-68-1	O,O,O-Triethylphosphorothioate		-	-	1.0×10^{-2}	-	8270

ATTACHMENT 1 (Continued)

Evaluation of Envirocorp Inc.'s HBLs and Detection Limits (Based on Reference Molecule Approach)

No.	CAS No.	Chemical Name	Reference Molecule	Envirocorp's HBL (mg/L)	USEPA/CAD's HBL (mg/L) 1/	Envirocorp's Detection Limit (mg/L)	ICF's Detection Limit (mg/L)	SW-846 Analytical Test Method
429	99-35-4	1,3,5-Trinitrobenzene		-	2.0×10^{-3} c	1.0×10^{-2}	1.0×10^{-2}	8270
430	52-24-4	Tris(1-aziridinyl) phosphine sulfide	Parathion	-	-	1.0×10^{-2}	1.0×10^{-2}	8270
431	125-72-7	Tris(2,3-dibromopropyl) phosphate		-	3.0×10^{-5} c	2.0×10^{-1}	1.0×10^{-2}	8270
432	72-57-1	Trypan blue	Aminoazobenzene	-	-	1.0×10^{-2}	1.0×10^{-2}	8270
433	66-75-1	Uracil mustard	Propylthiouracil	-	-	1.0×10^{-2}	1.0×10^{-2}	8270
434	1314-62-1	Vanadium pentoxide		7.0×10^{-1}	7.0×10^{-1} a	-	-	-
435	108-05-4	Vinyl acetate		-	$4.0 \times 10^{+1}$	5.0×10^{-3}	5.0×10^{-3}	8240
436	75-01-4	Vinyl chloride		2.0×10^{-3}	2.0×10^{-3}	-	-	-
437	81-81-2	Warfarin		1.0×10^{-2}	1.0×10^{-2} b	-	-	-
438		Warfarin salts, when present at concentrations less than 0.3%		1.0×10^{-2}	1.0×10^{-2} b	-	-	-
439		Warfarin salts, when present at concentrations greater than 0.3%		1.0×10^{-2}	1.0×10^{-2} b	-	-	-
440	1330-20-7	Xylene		$1.0 \times 10^{+1}$	$1.0 \times 10^{+1}$	-	-	-
441	557-21-1	Zinc cyanide		$2.0 \times 10^{+0}$	$2.0 \times 10^{+0}$	-	-	-
442	1314-84-7	Zinc phosphide		1.0×10^{-2}	1.0×10^{-2} a	-	-	-

NA: Not available at this time.
*: ICF's recommended Reference Molecule.

1/ HBLs from "Computer Print-Out of 40 CFR §264, Appendix IX Constituents," June 12, 1992, Prepared by EPA's Office of Characterization and Assessment.
2/ This compound is also listed as dichloromethoxyethane.
3/ This compound is also listed as dichloroisopropyl ether.
4/ ICF was unable to locate the correct CAS number for this compound.

a - HBLs from "Concentration Limits applicable to 'No Migration' Petitions for Injected Hazardous Wastes," US EPA Office of Drinking Water, October 1990.
b - HBLs from "Docket Report of Health Based Levels and Solubilities for Additional Compounds Used in the Evaluation of Delisting Petitions, Submitted Under 40 CFR §260.20 and §260.22," July 1992, Prepared for the Delisting Section.
c - HBLs from "Docket Report of Health Based Levels and Solubilities Used in the Evaluation of Delisting Petitions, Submitted Under 40 CFR §260.20 and §260.22," July 1992, Prepared for the Delisting Section.
d - HBL for metal-NOS assumed to be the same as the metal.